Wildlife as reservoirs for vector borne diseases in a warmer Scandinavian climate

Bødker, Rene; Kristensen, Birgit

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Wildlife as reservoirs for vector borne diseases in a warmer Scandinavian climate

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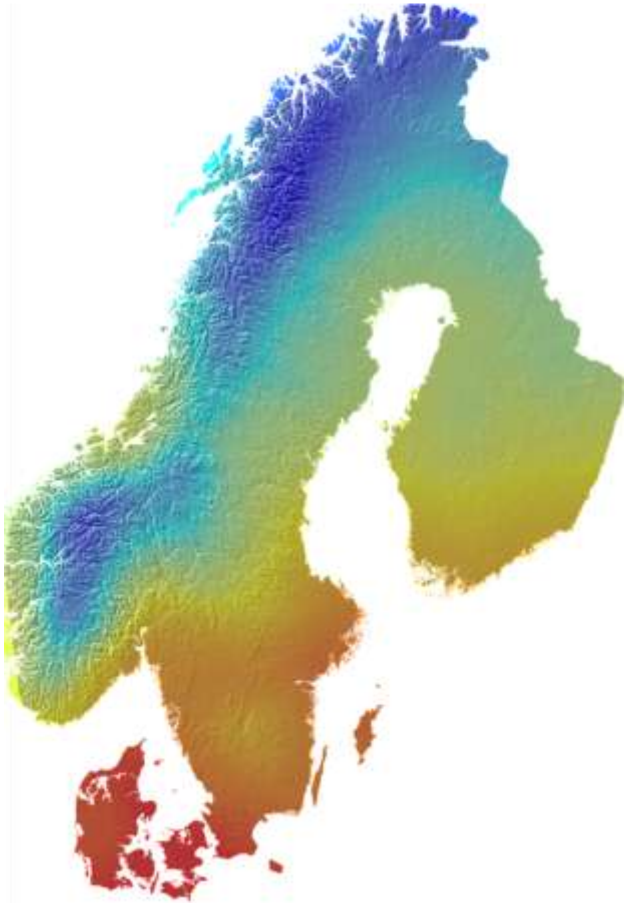
René Bødker
Birgit Kristensen
Kaare Græsbøll
Carsten Kirkeby
Anders Stockmarr
Mette Fertner
Lasse E. Christiansen

The NordRisk data base for modelling vector borne diseases



www.nordrisk.dk

Nordic Climate Change
Modelling vectorborne diseases

DTU Veterinary
National Veterinary Institute

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- ⊞ Climate projections
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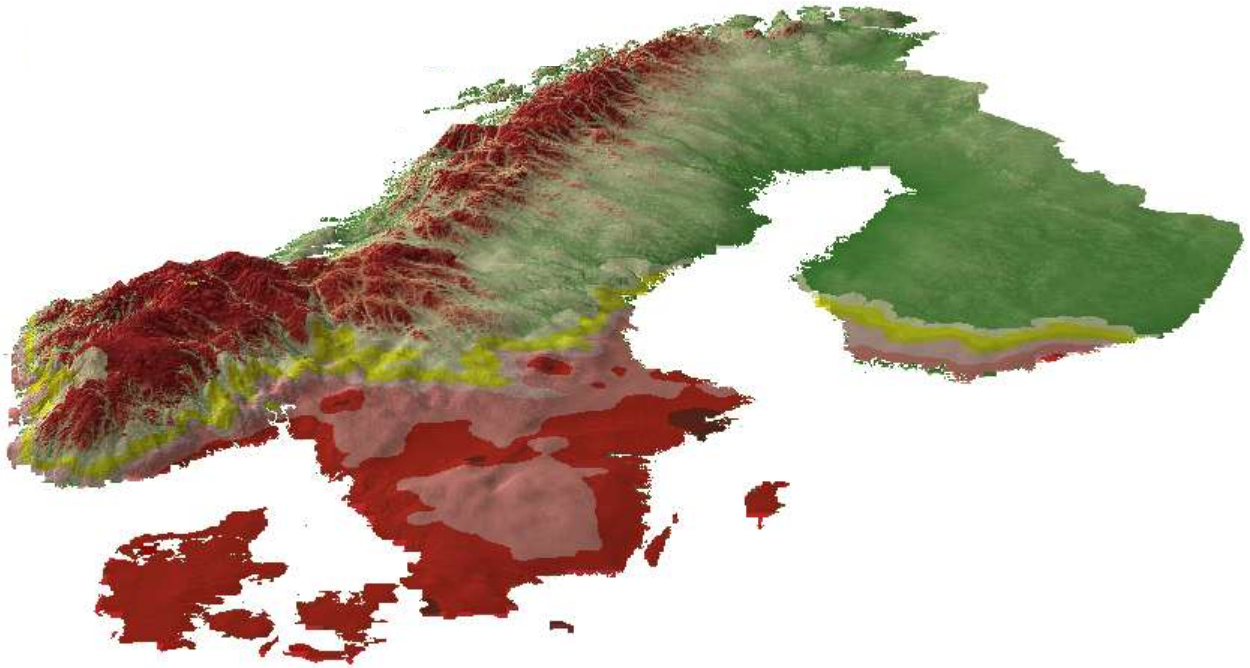


Division of Veterinary Diagnostics and Research
National Veterinary Institute, Technical University of Denmark

norden
Nordic Council of Ministers

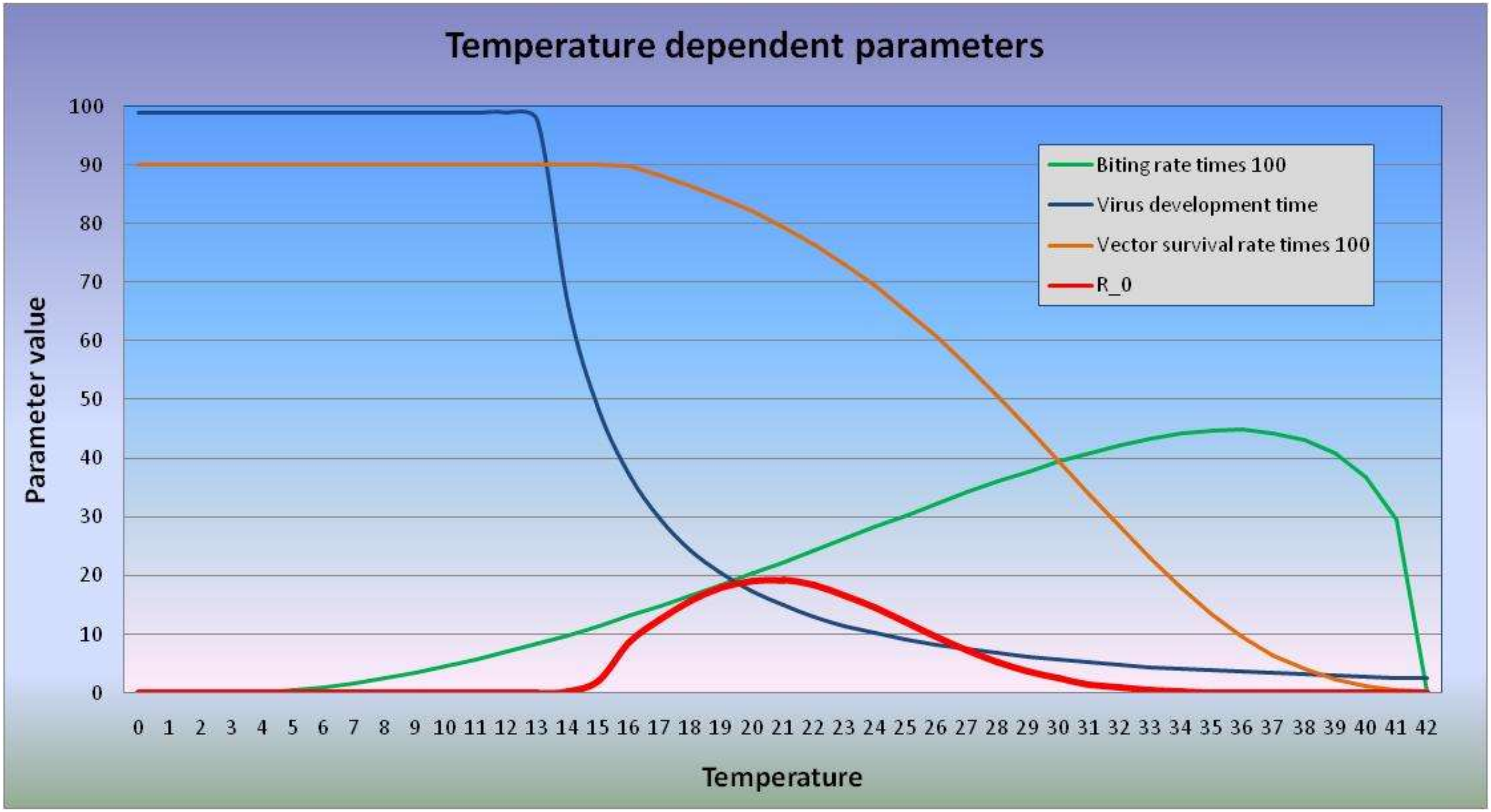
Internet 100%

Parameterisation of model

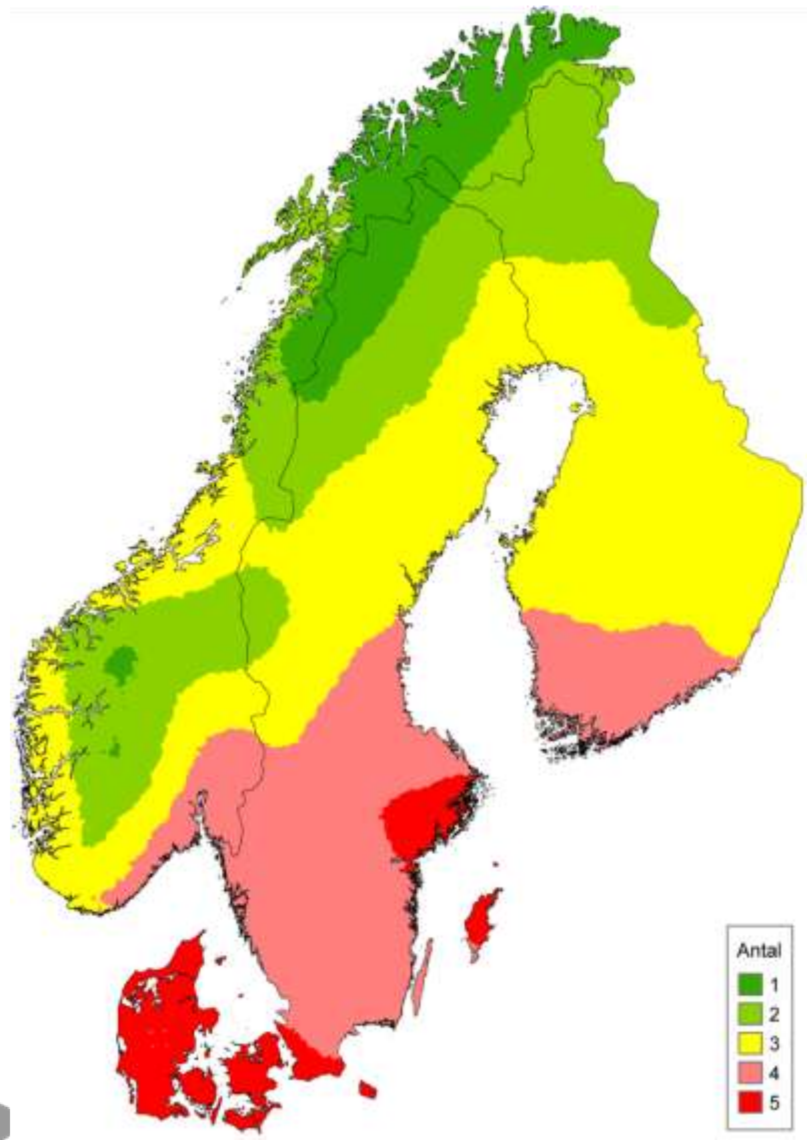
Drivers: | **Model parameters:**

Drivers	Model parameters
Environment	Number of vectors
Temperature	How often the vector bites How long it takes for the virus to develop in the vectors The vectors daily survival rate (how long they live)
Disease specific	How long a cow is infectious to the vectors The probability of transmission from an infectious host to a vector The probability of transmission from an infectious vector to a host

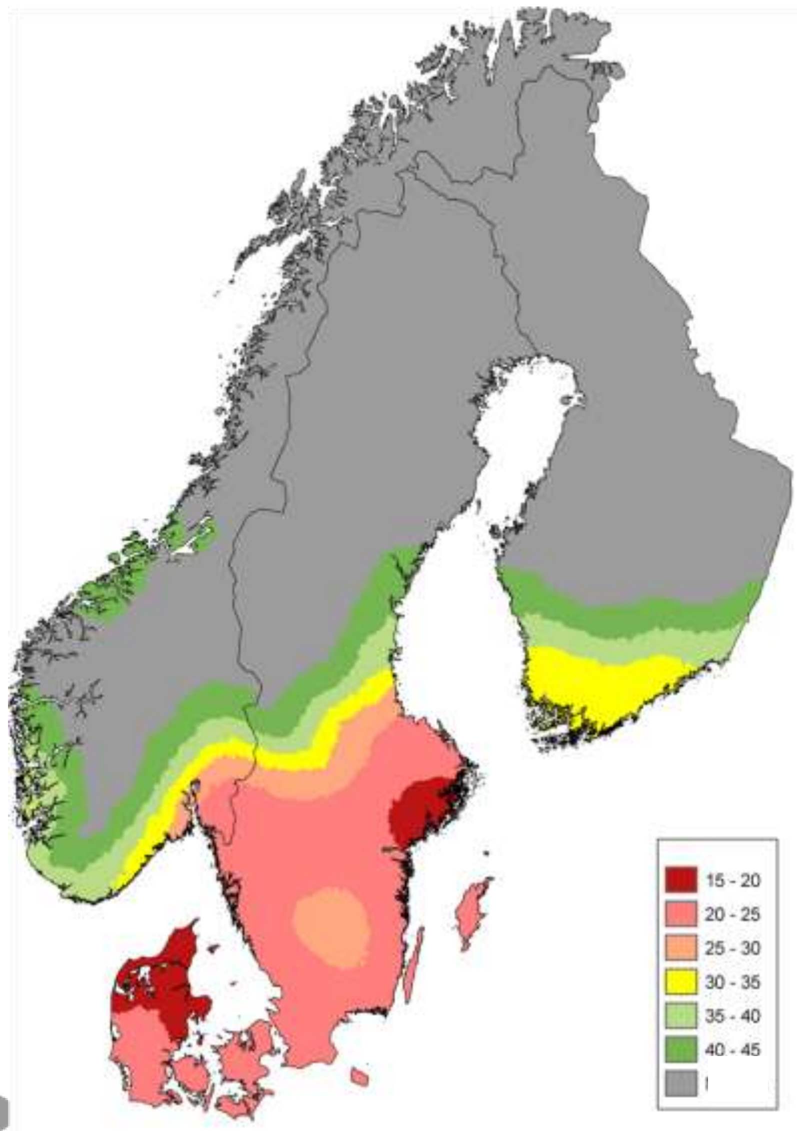
Basic transmission parameters



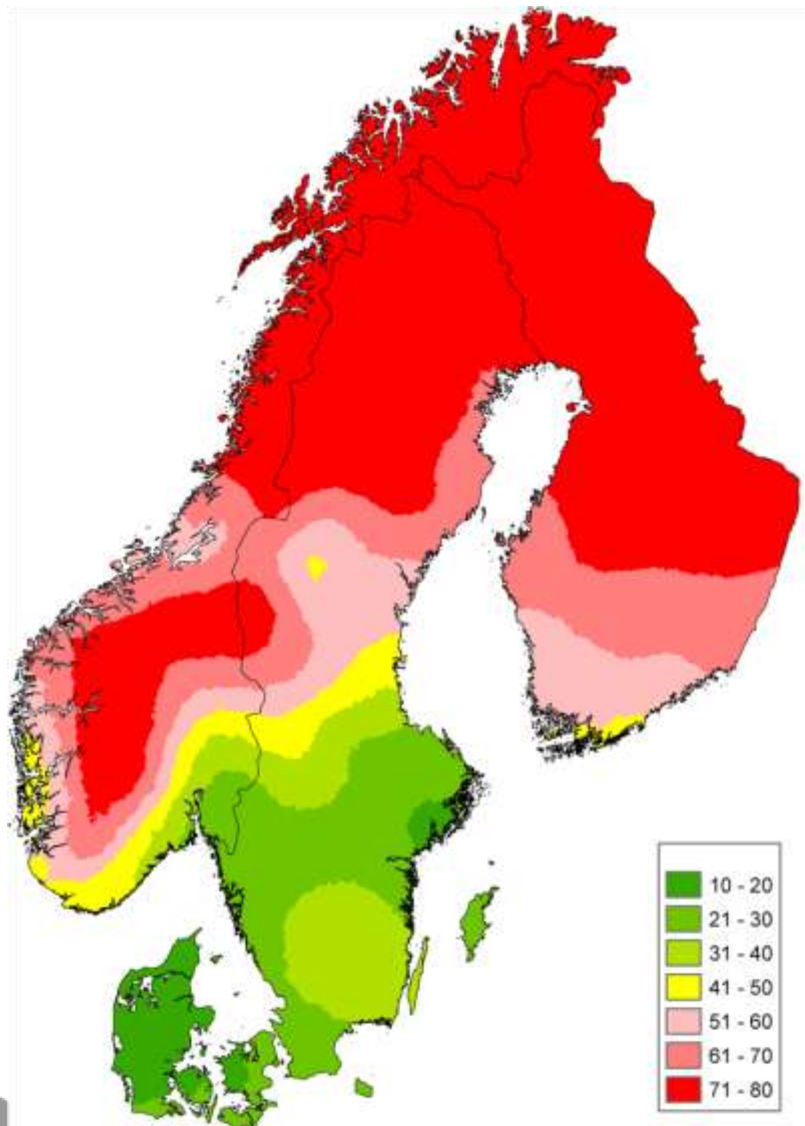
The maximum number of additional blood meals per vector in 2008



Virus development time in a vector infected 20th July 2008

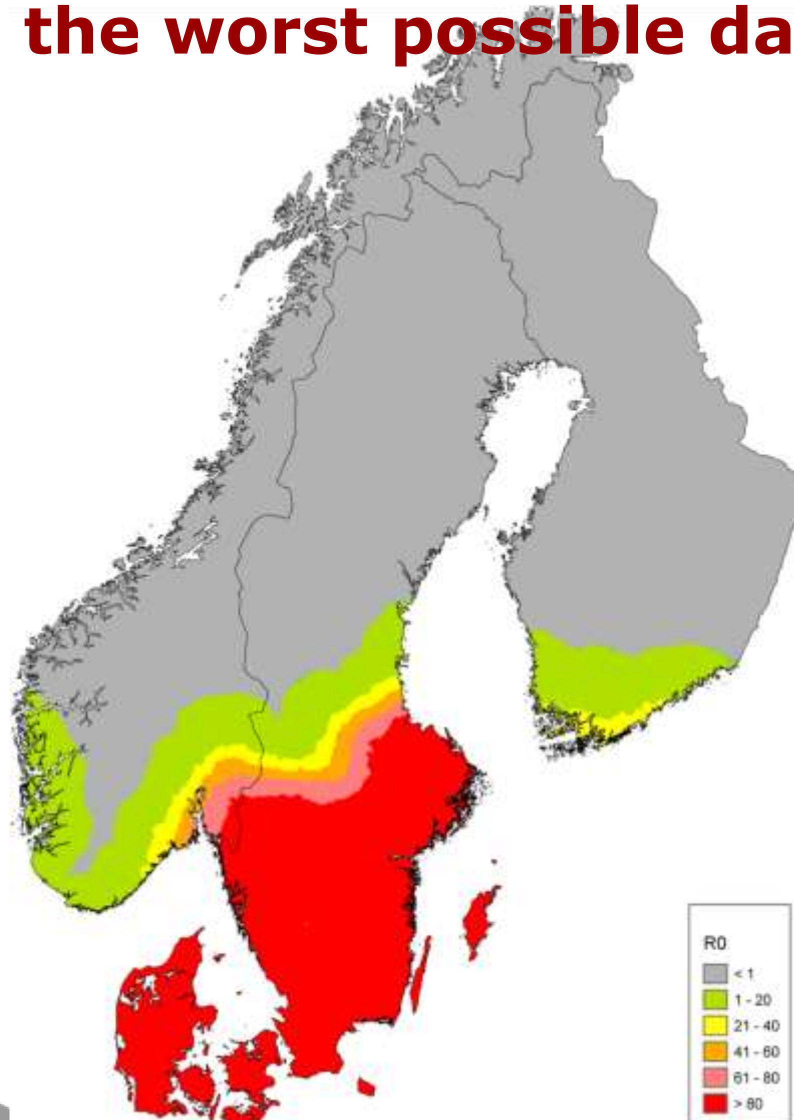


How many vectors survive 25 days after feeding 20th July 2008?



The highest R0 for an introduced infectious cow in 2008

– the worst possible day!



The highest R0 for an introduced infectious cow in 2008

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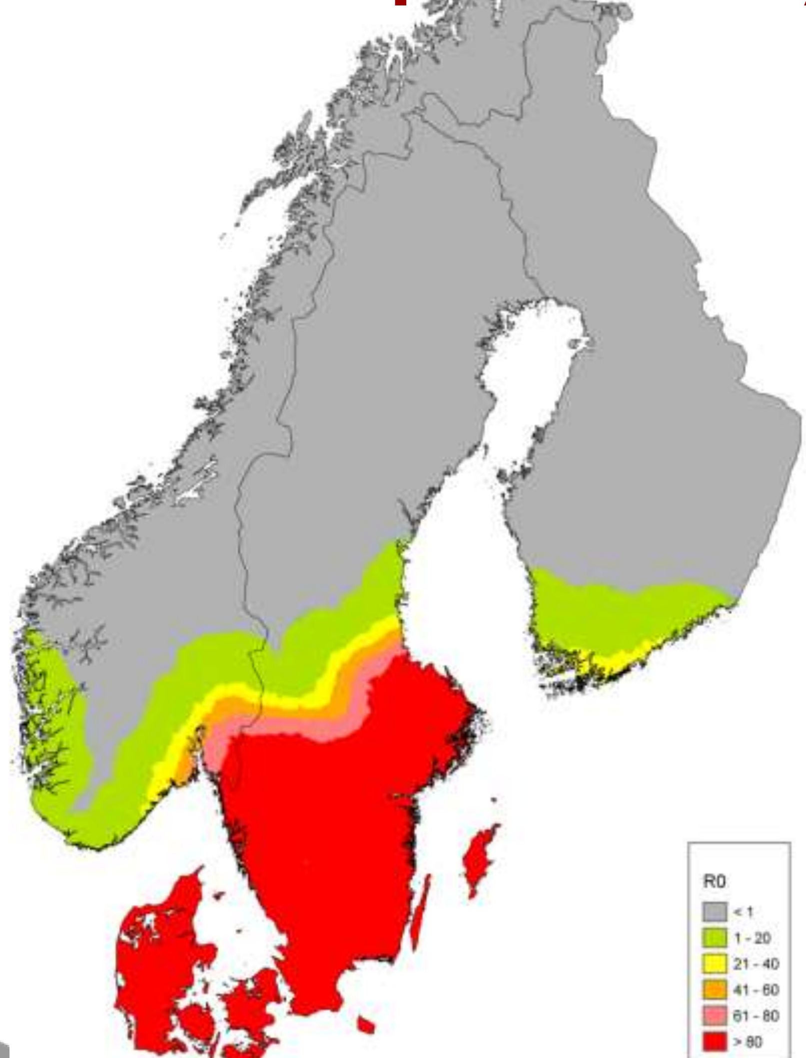
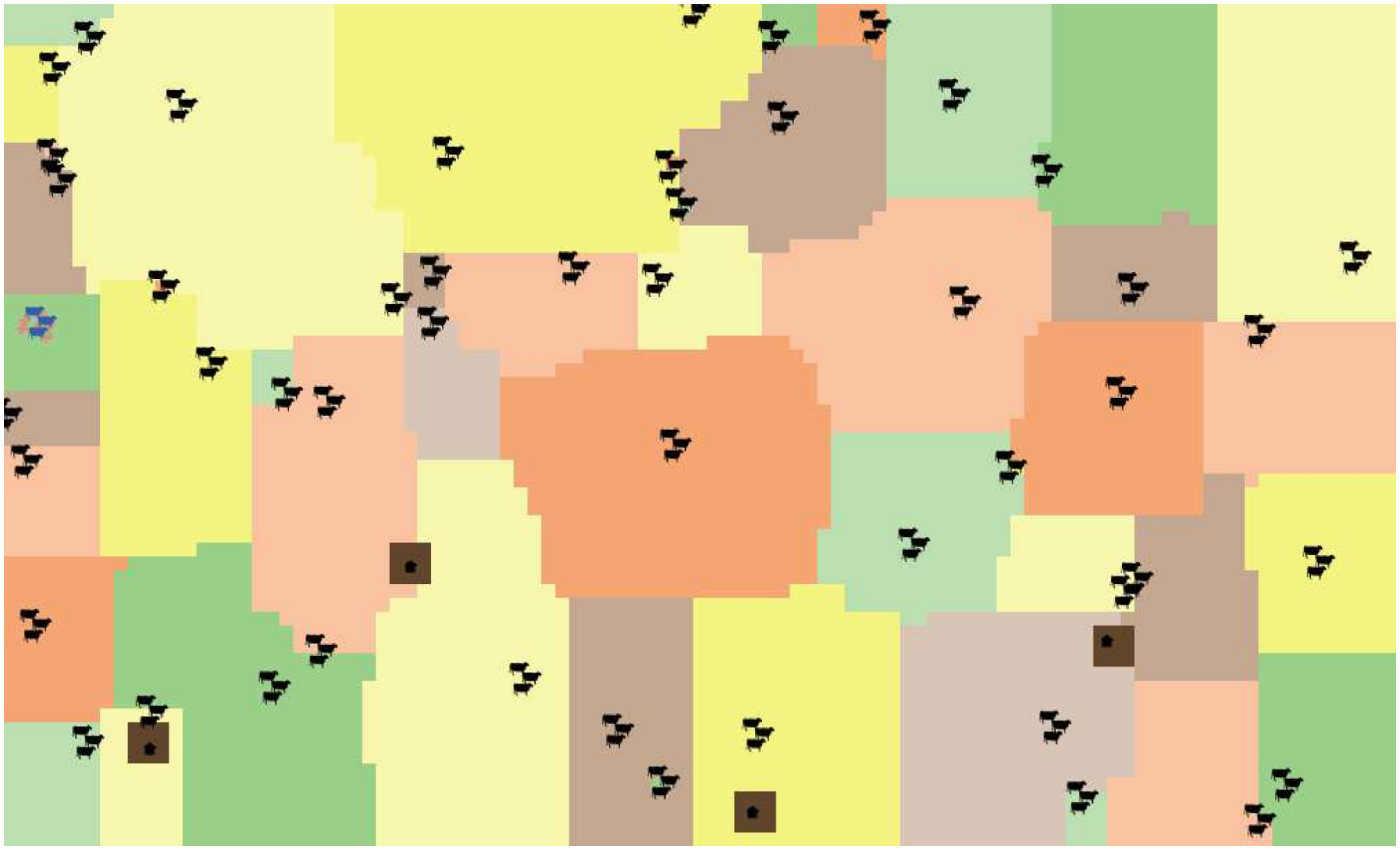


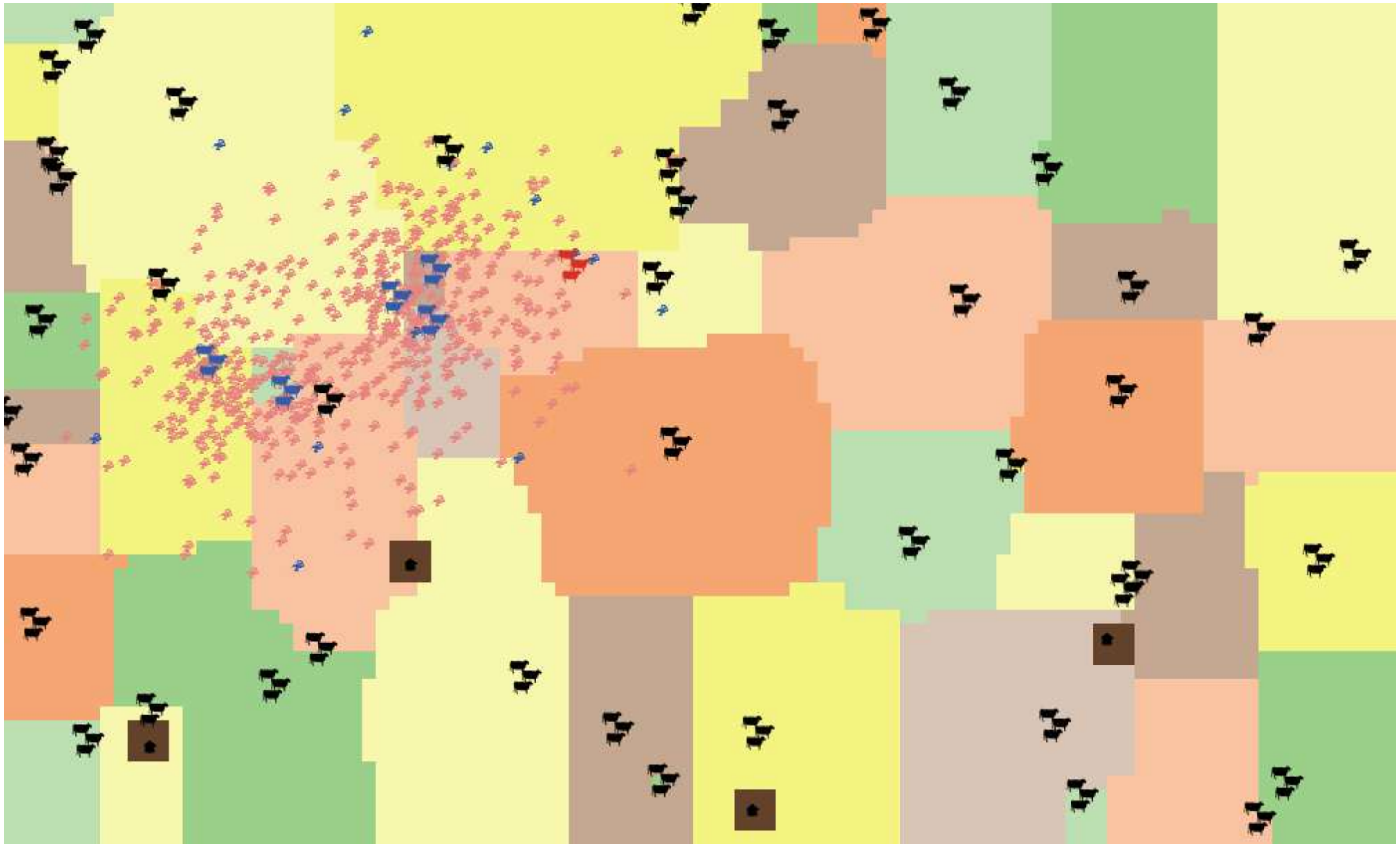
Role of wild ruminant..
Vet. Res. 2011, **42**:88

Planning prevention and control

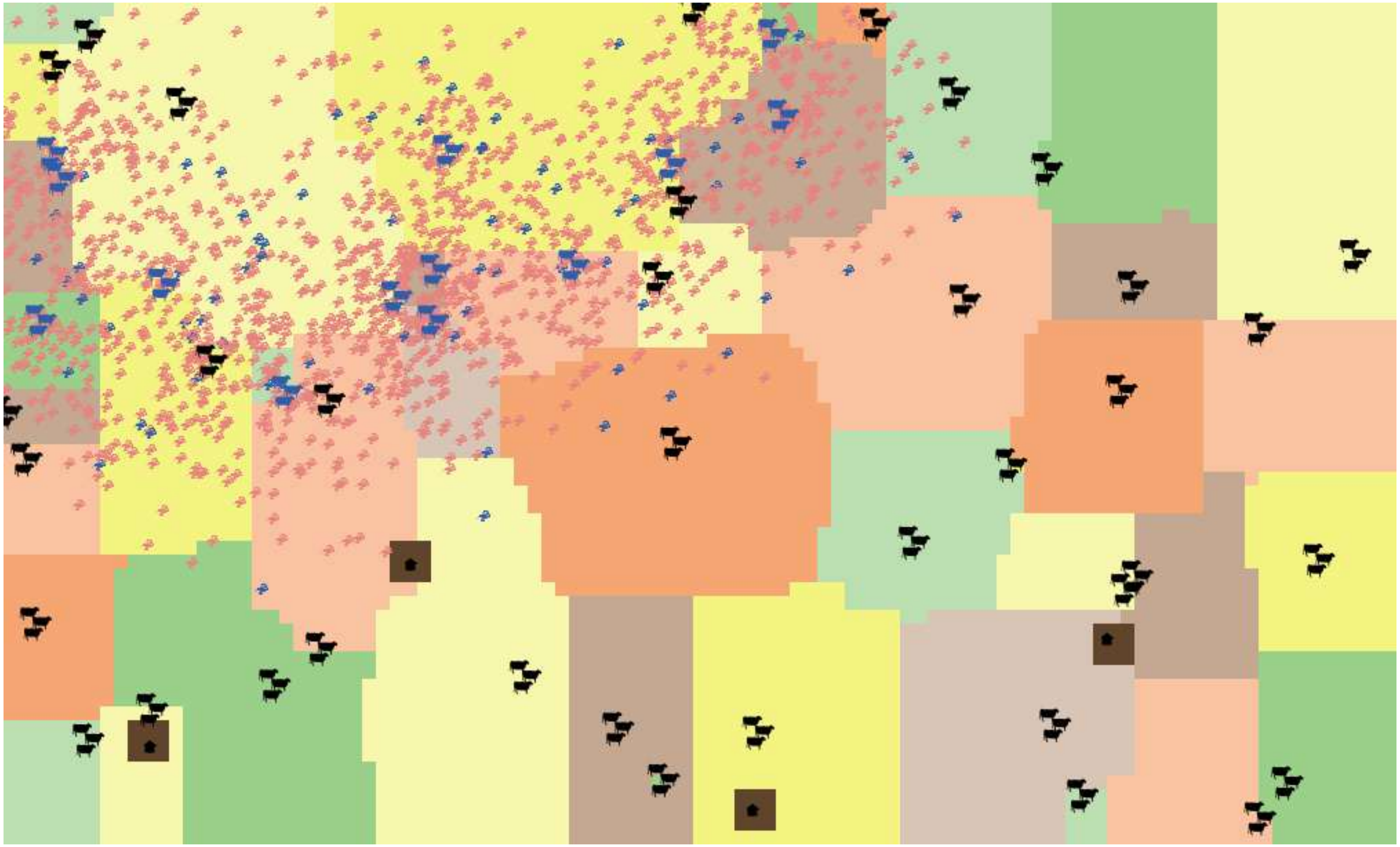
Planning prevention and control



Planning prevention and control



Planning prevention and control



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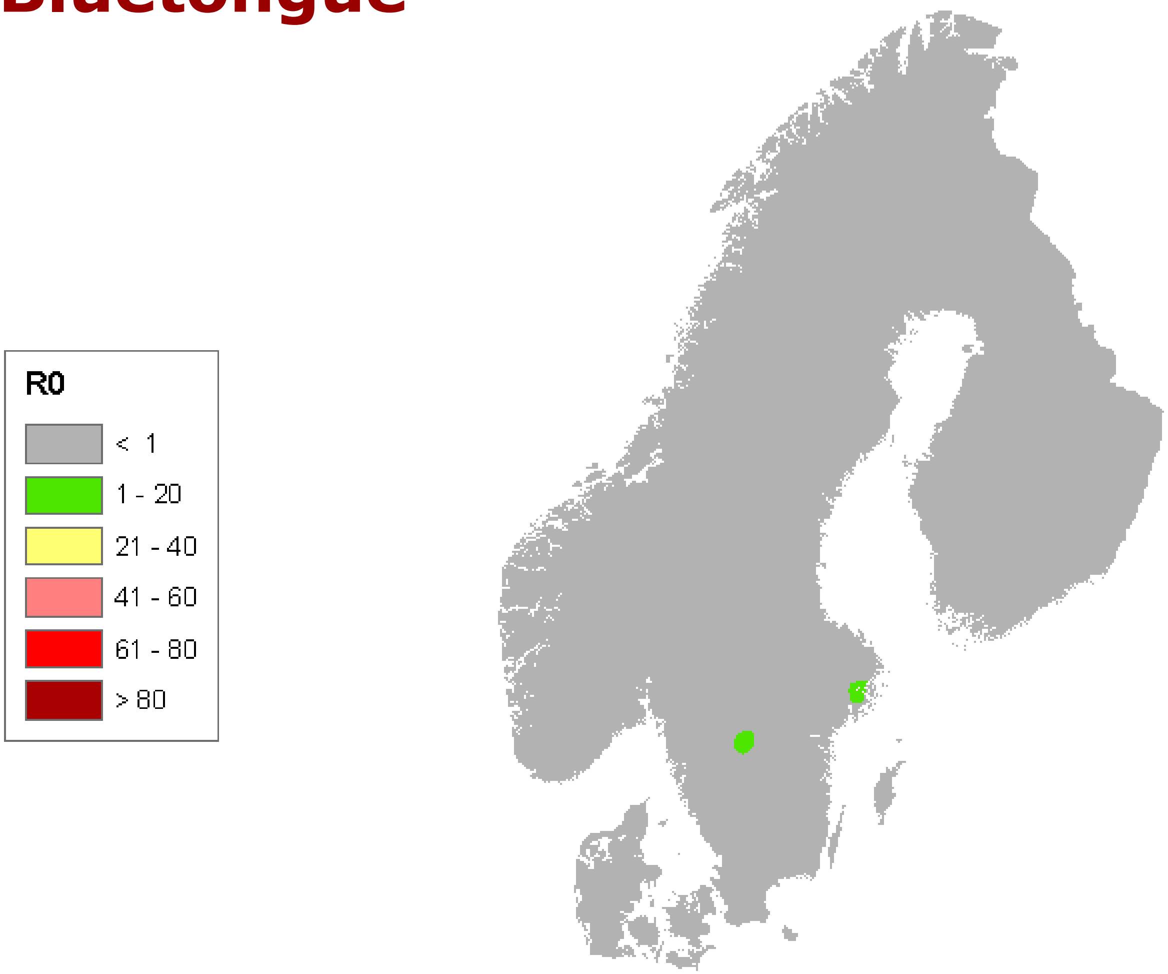

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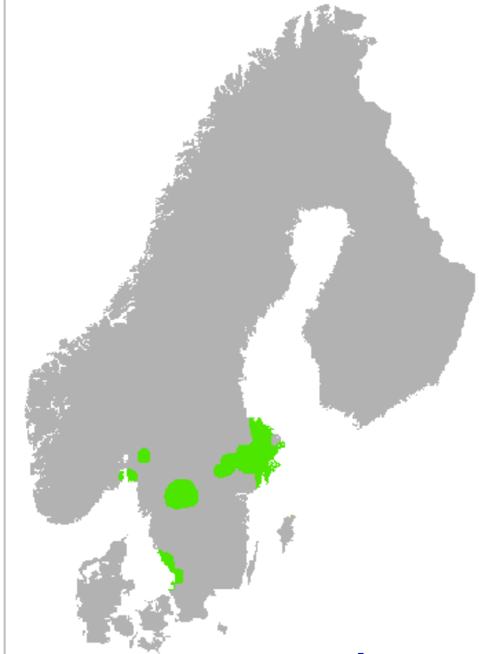

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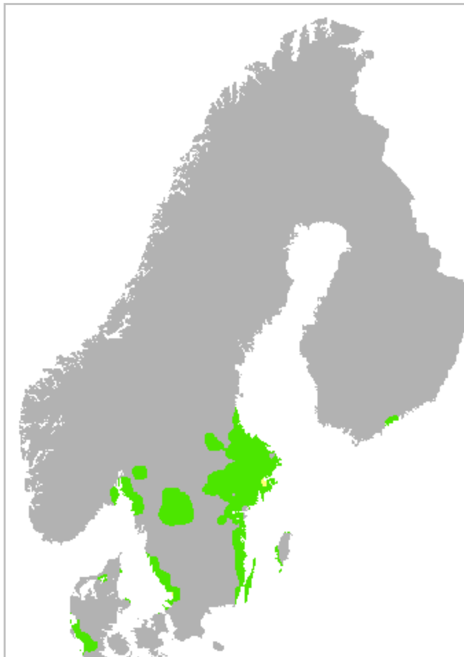

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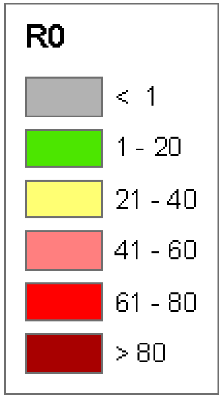

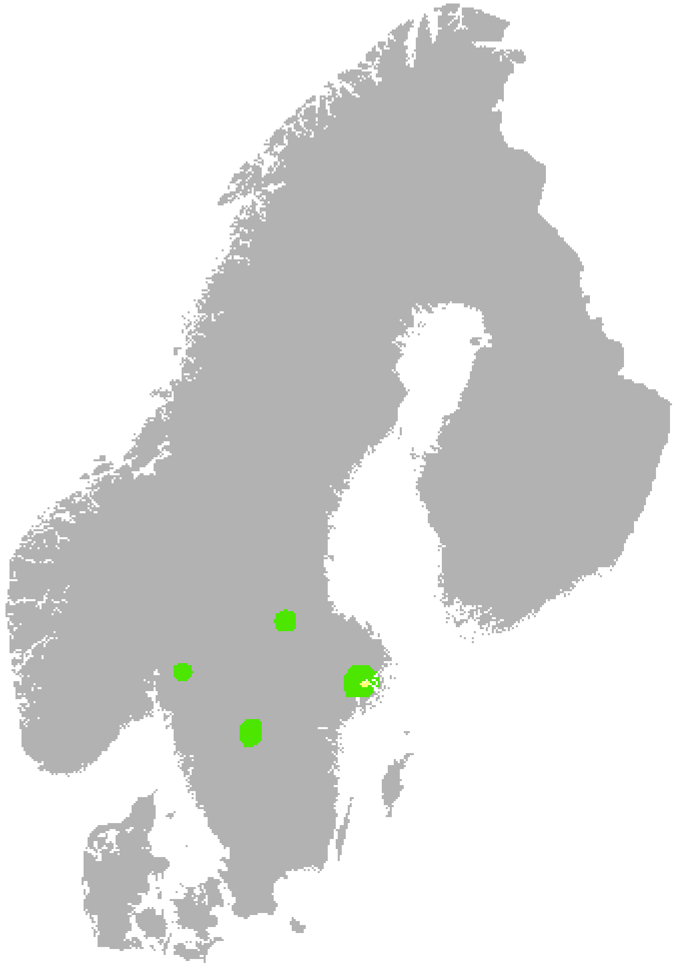

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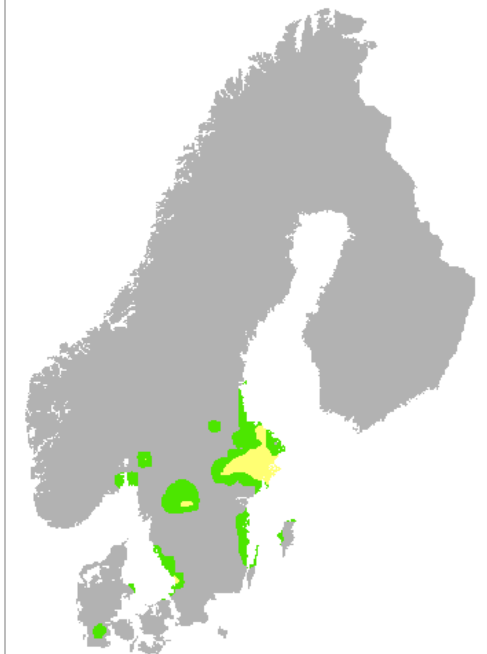

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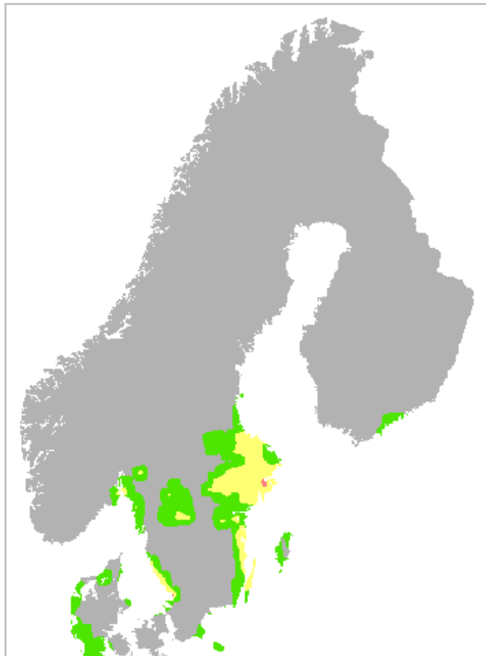

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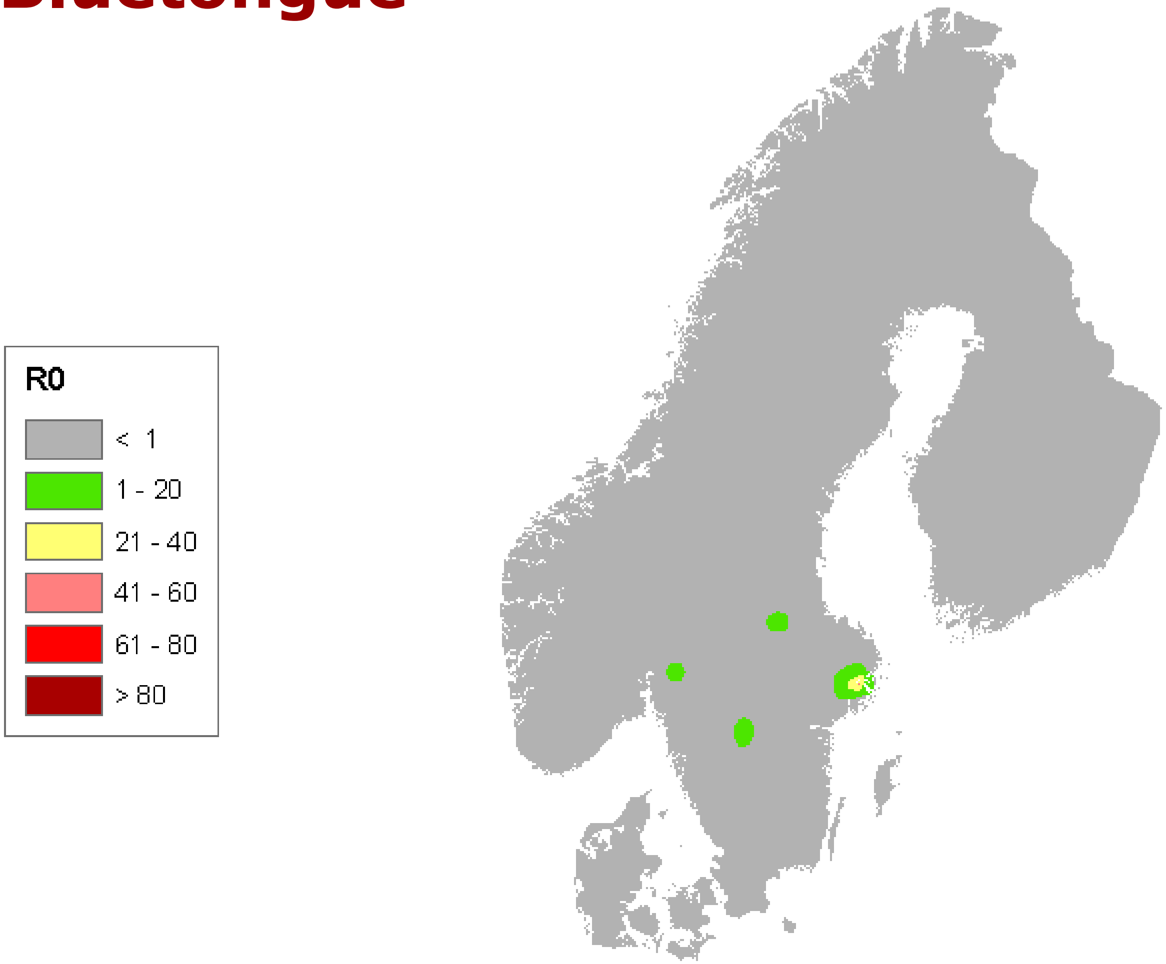

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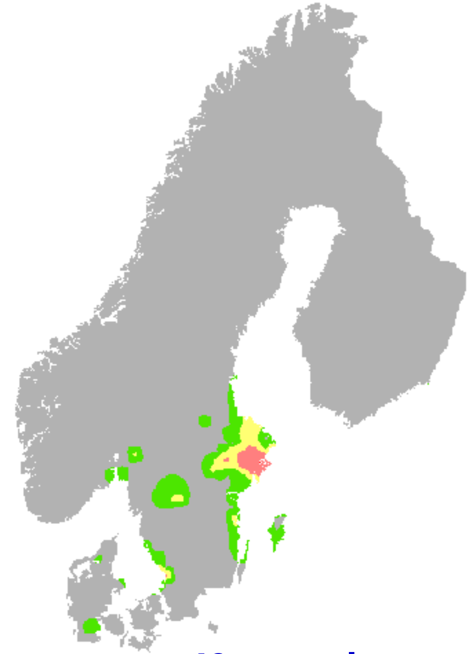

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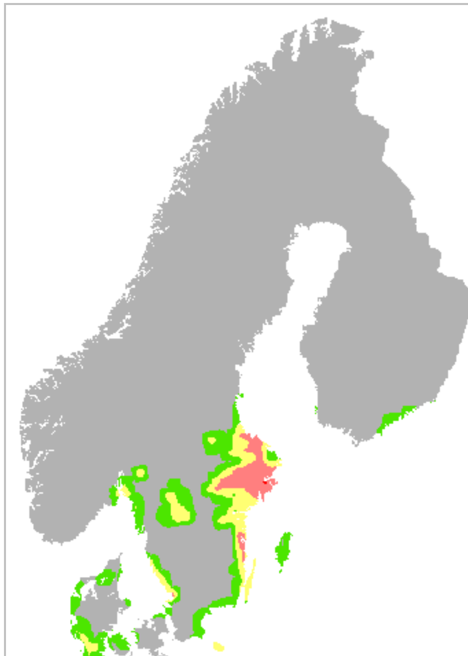

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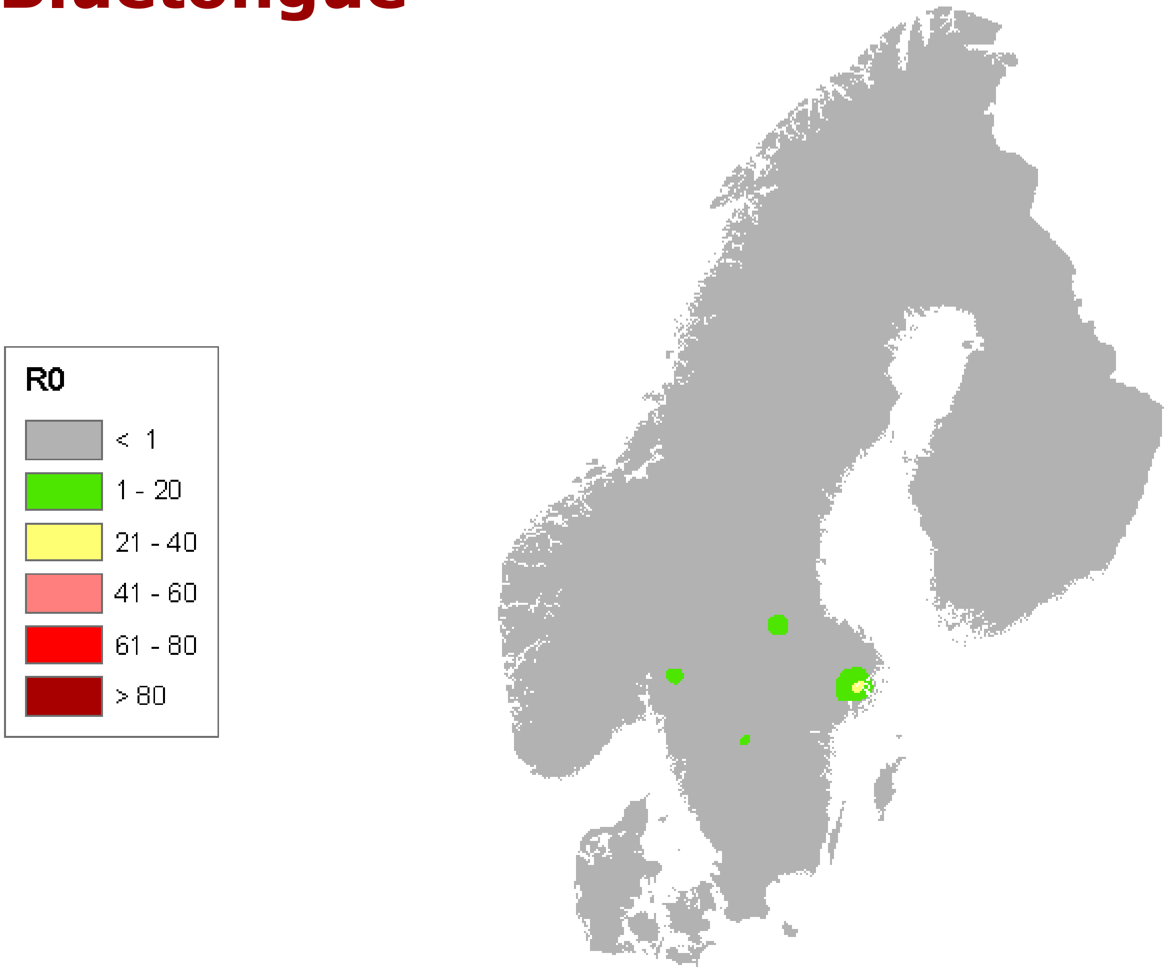

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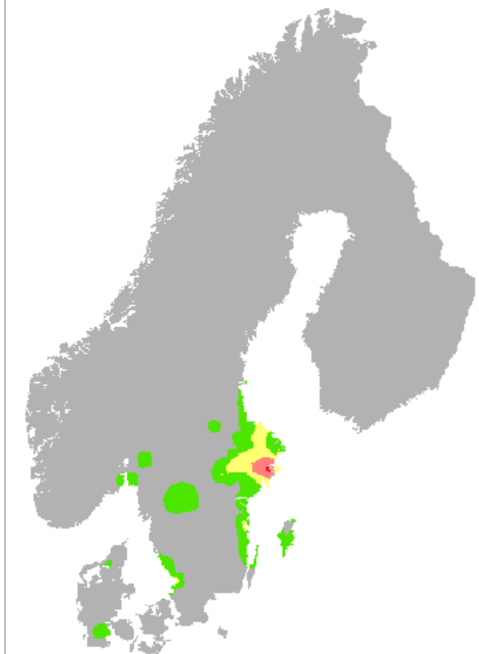

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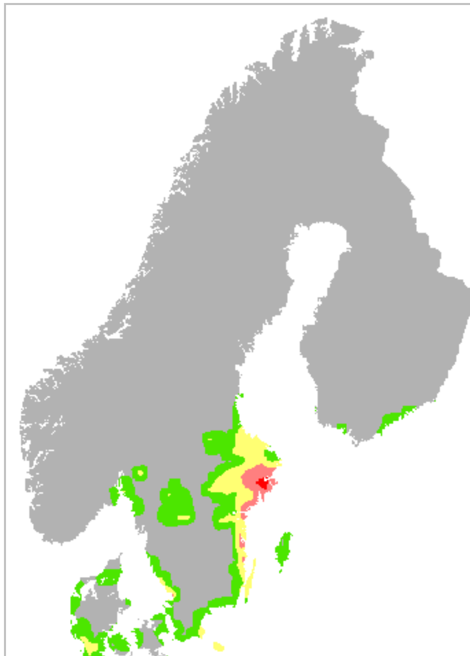

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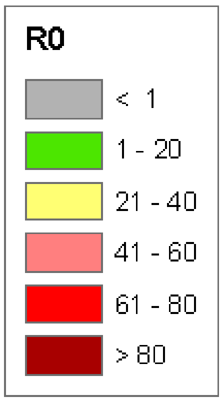

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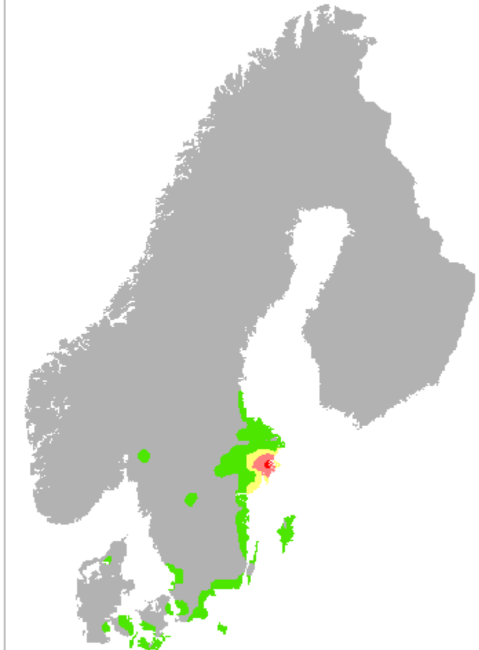

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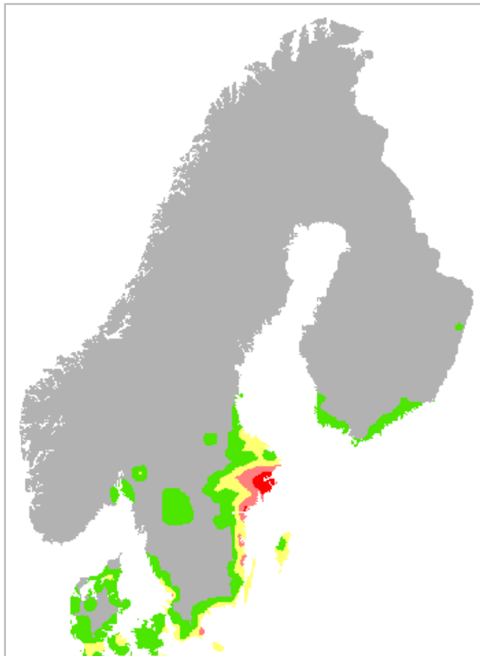

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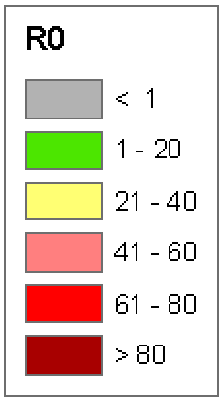

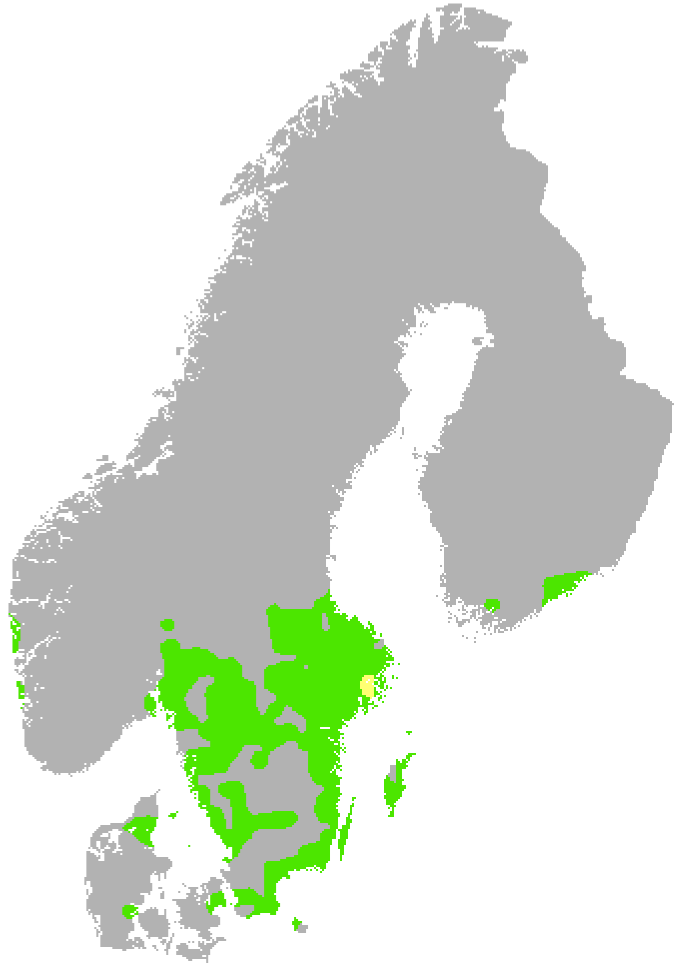

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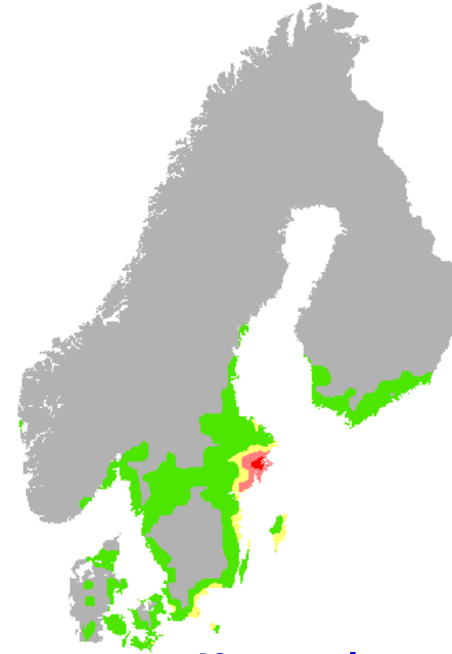

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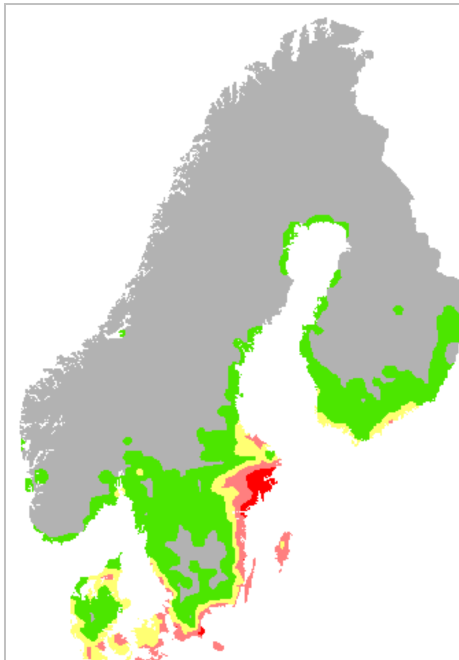
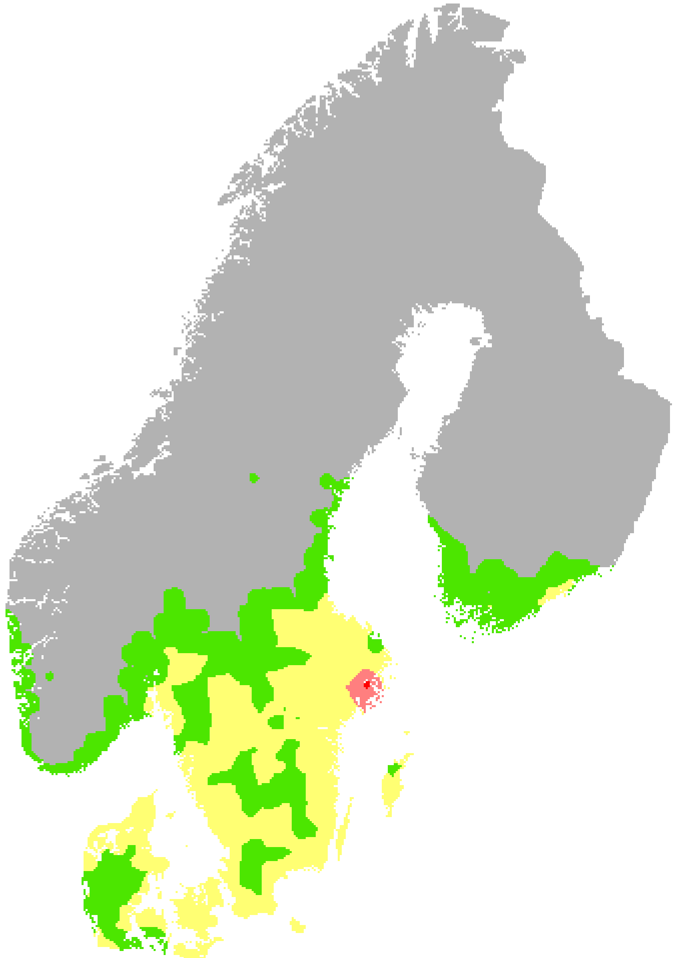


60 years later

Bluetongue

R0

(grey)	< 1
(green)	1 - 20
(yellow)	21 - 40
(pink)	41 - 60
(red)	61 - 80
(dark red)	> 80



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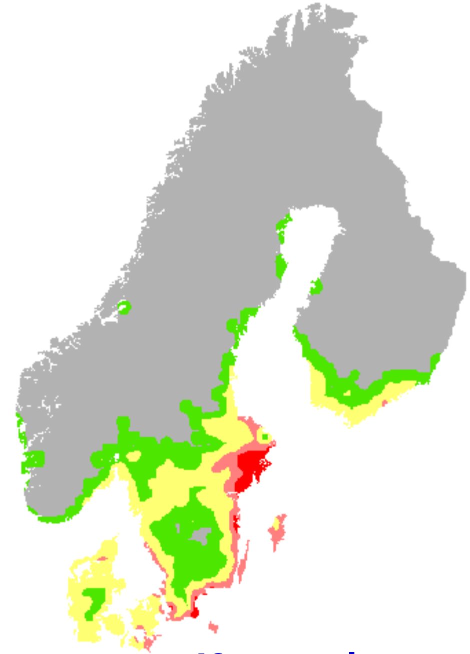

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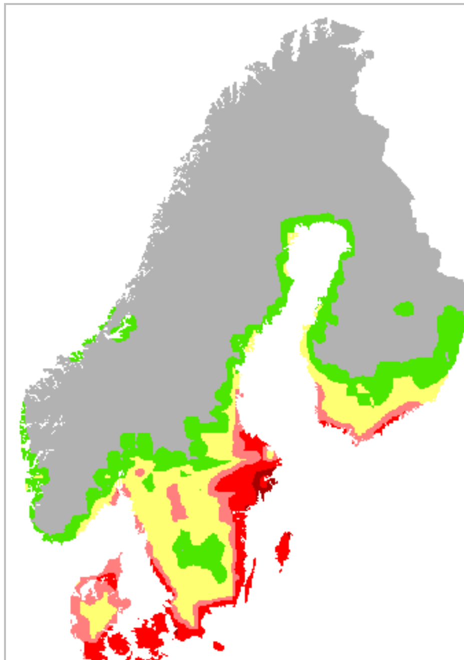

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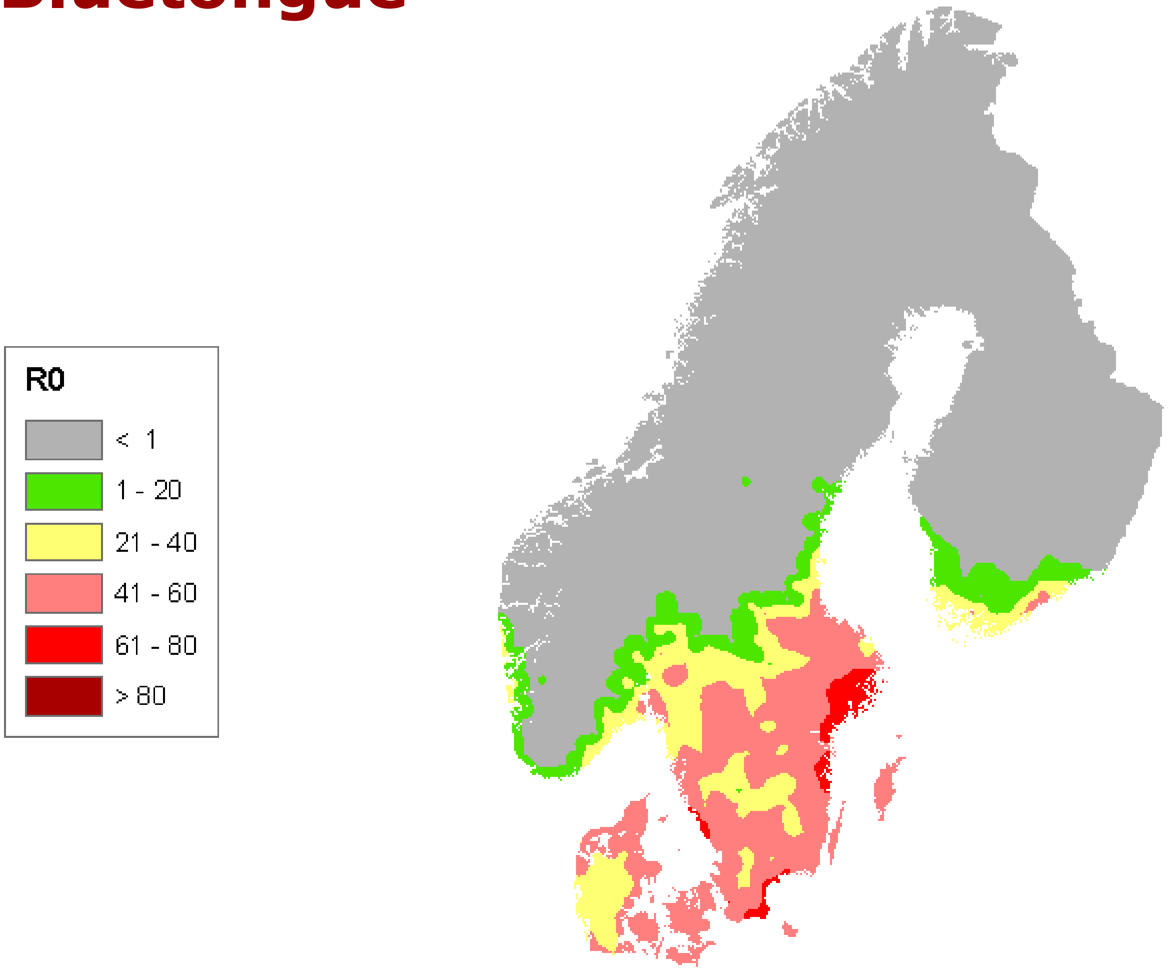

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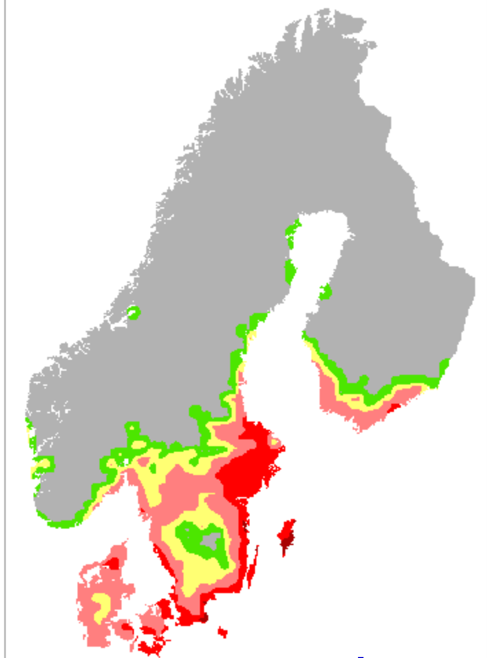

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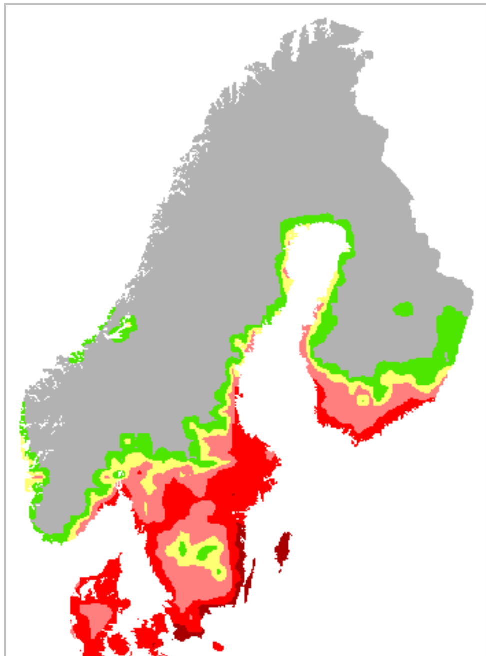

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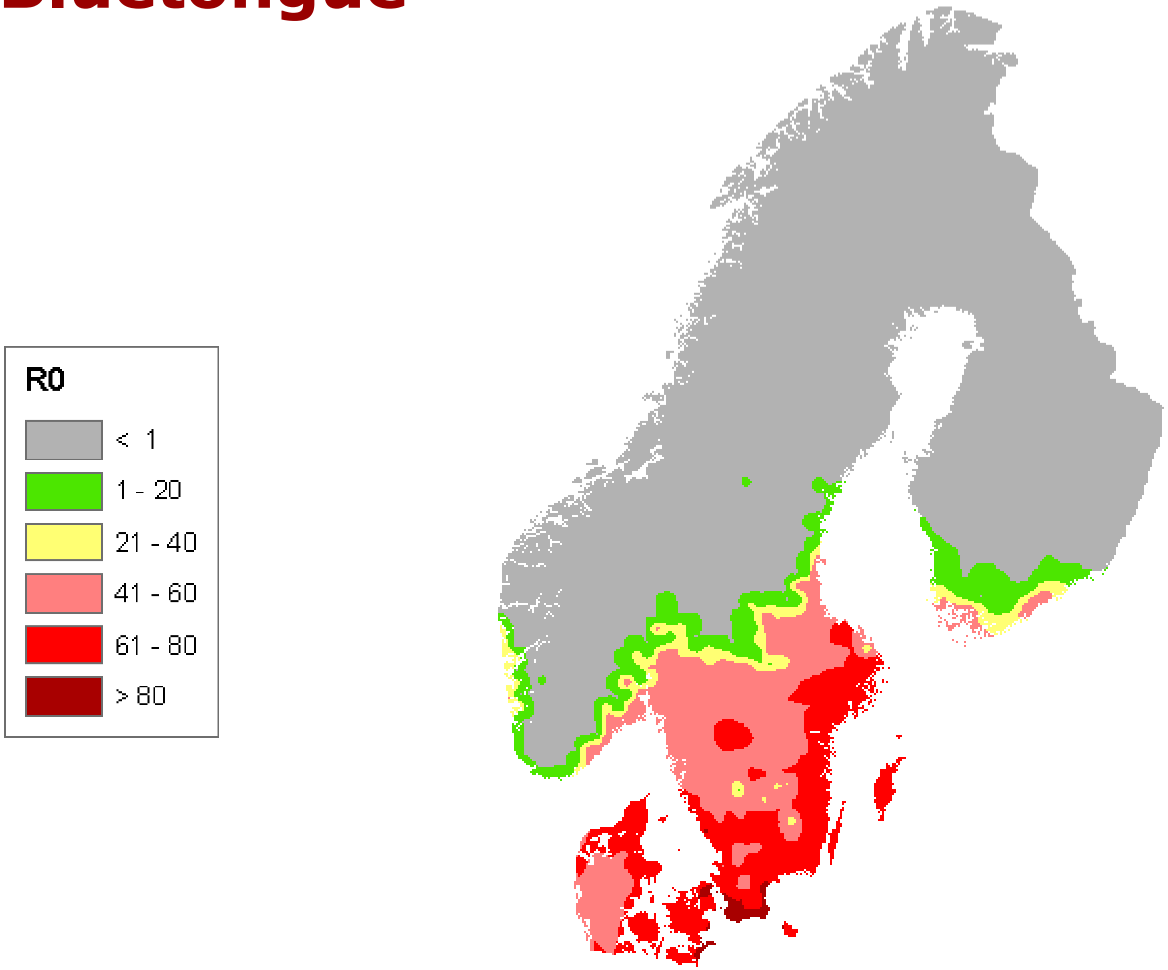

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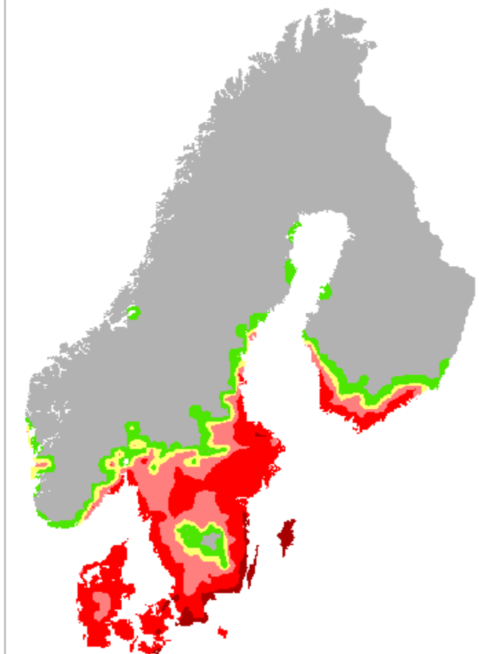

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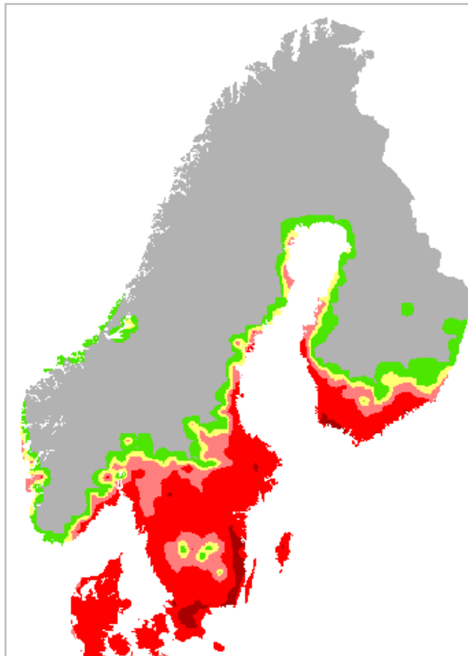

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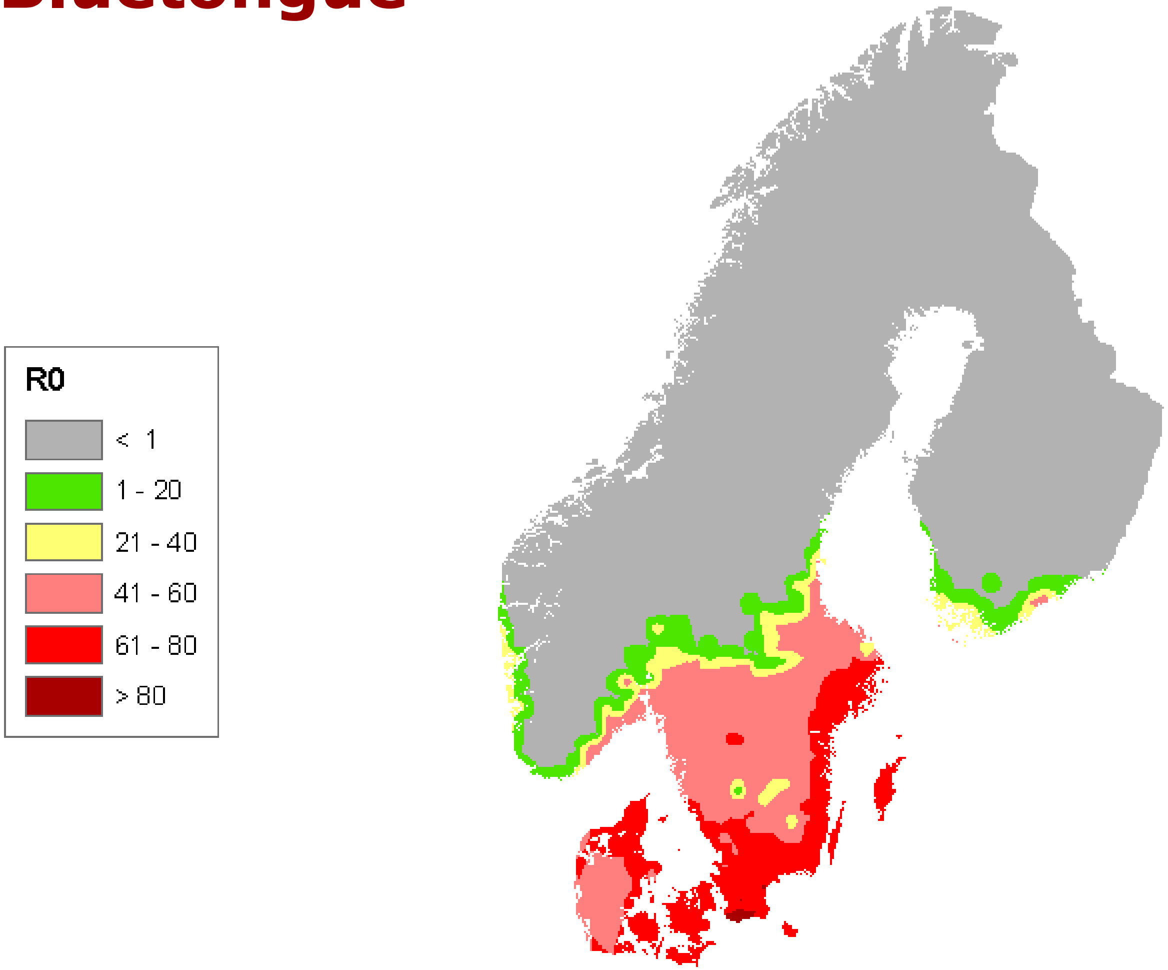

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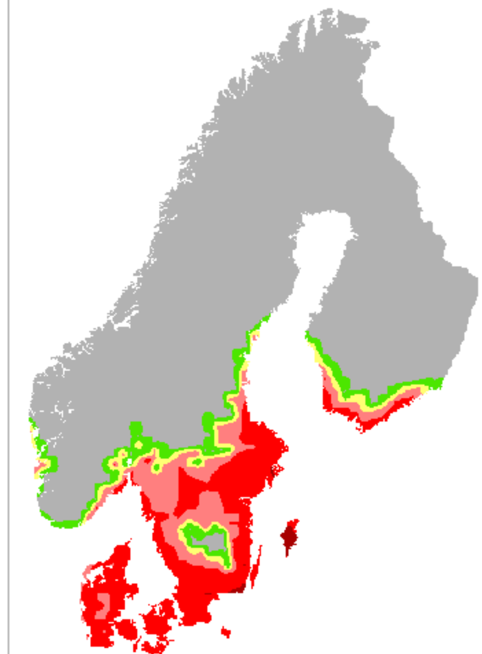

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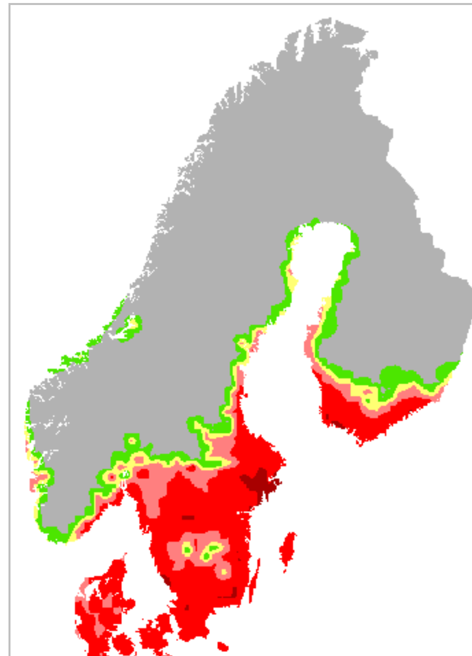
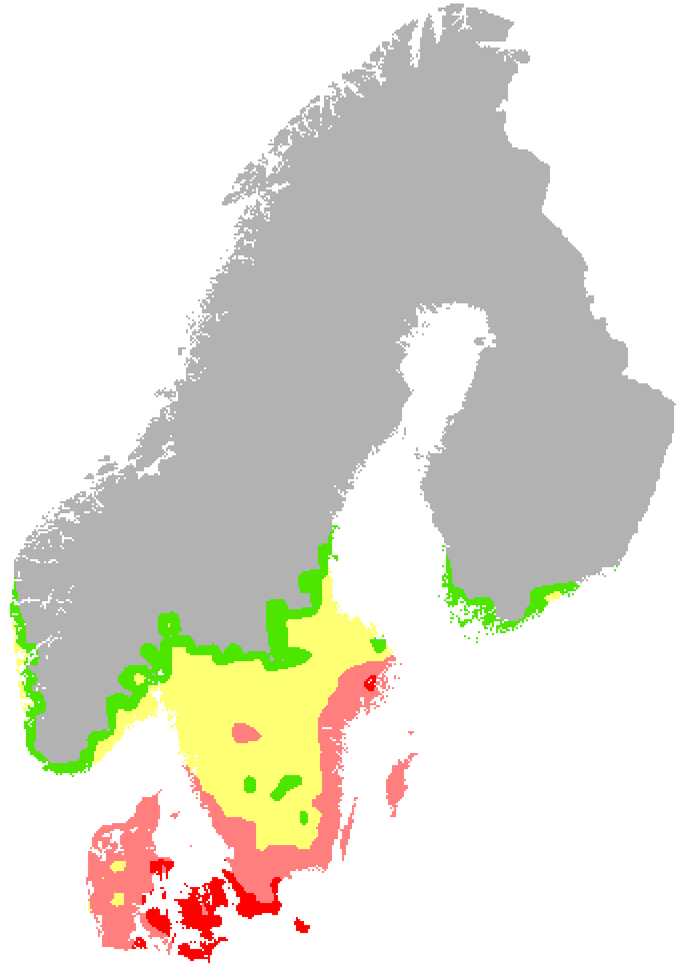


60 years later

Bluetongue

R0

- < 1
- 1 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- > 80



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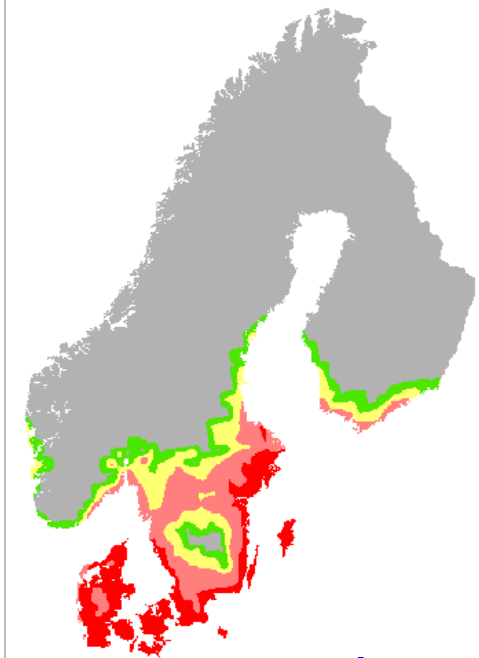

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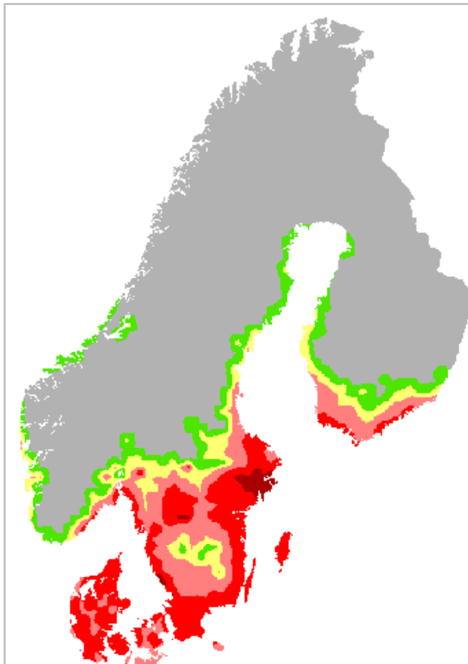

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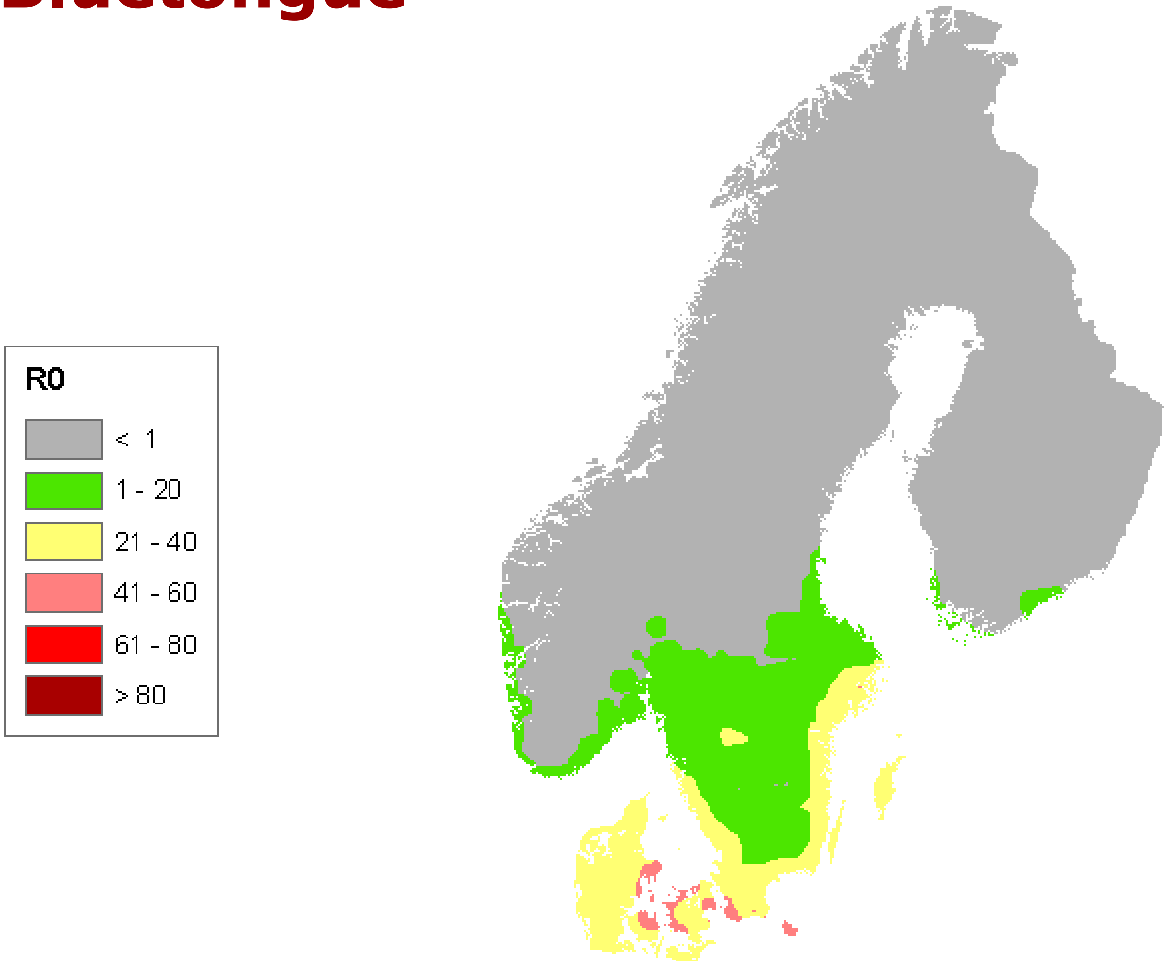

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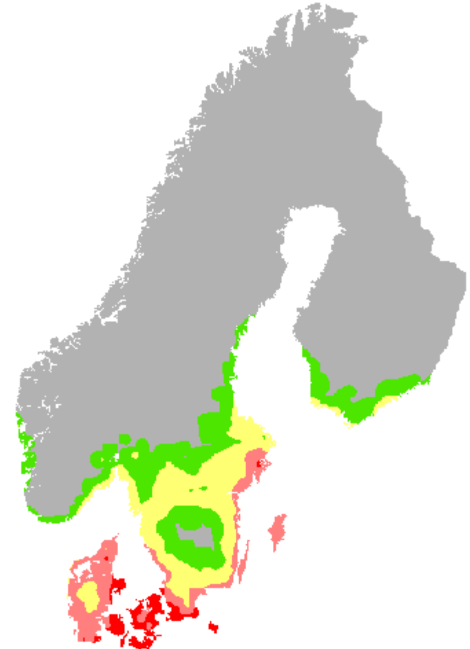

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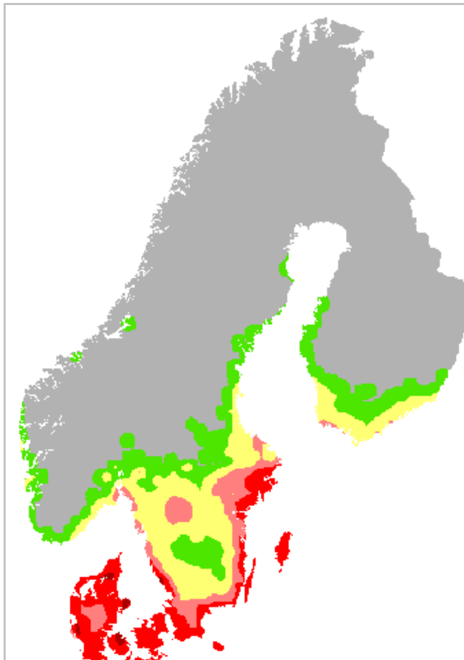

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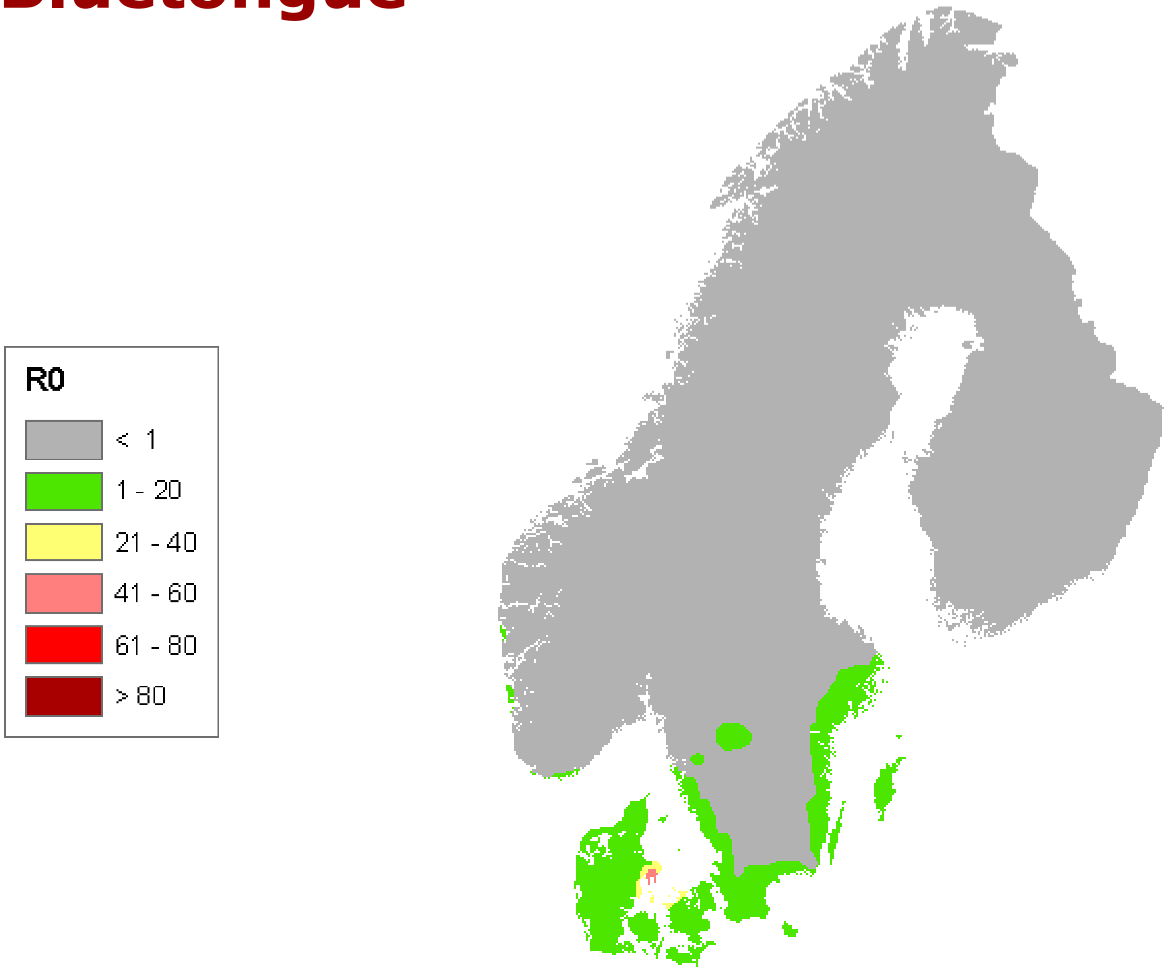

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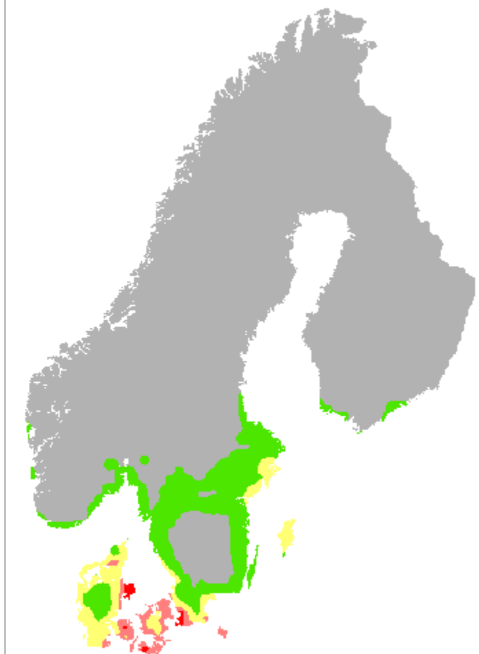

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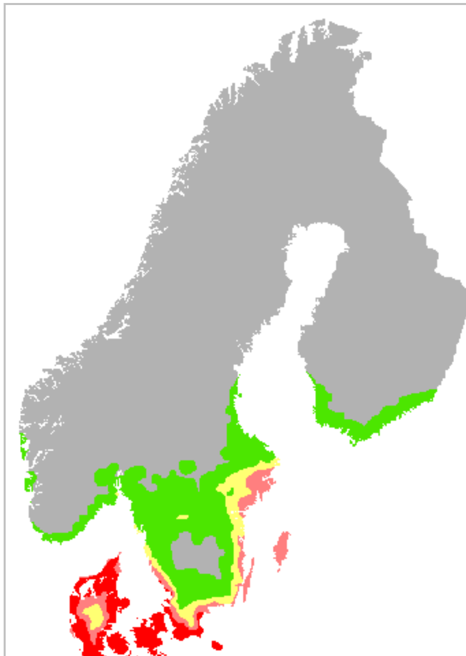

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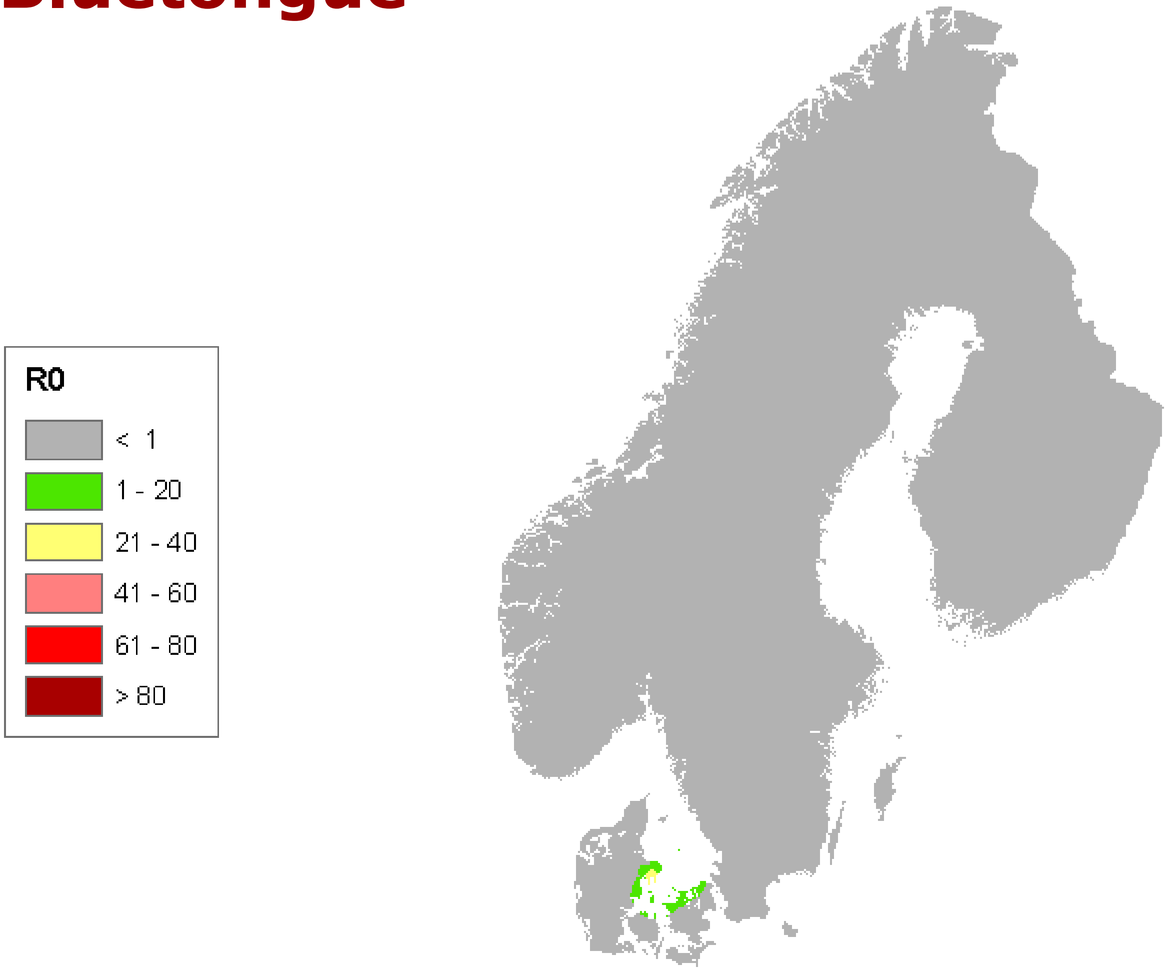

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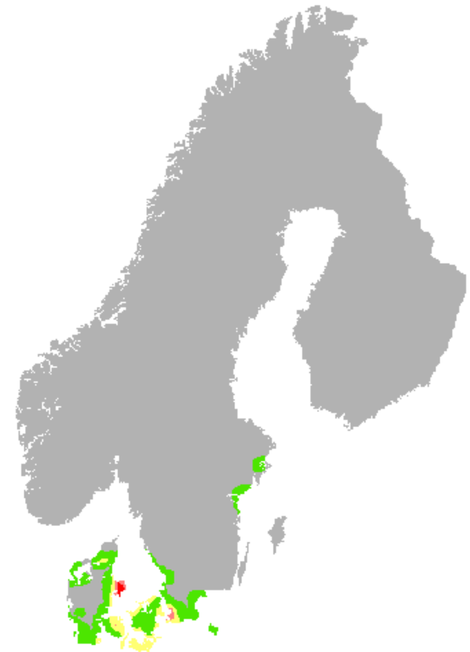

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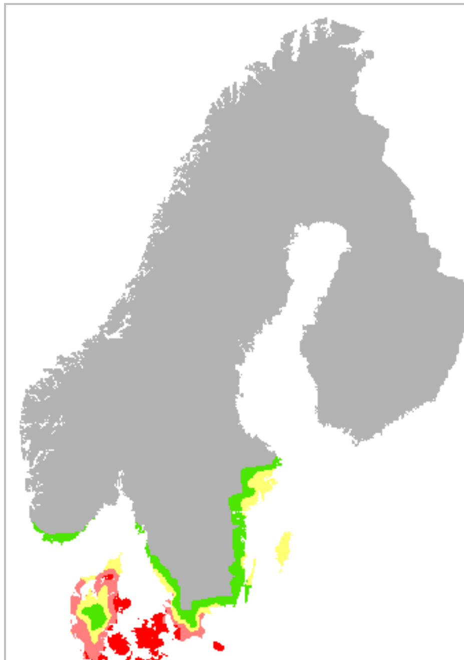

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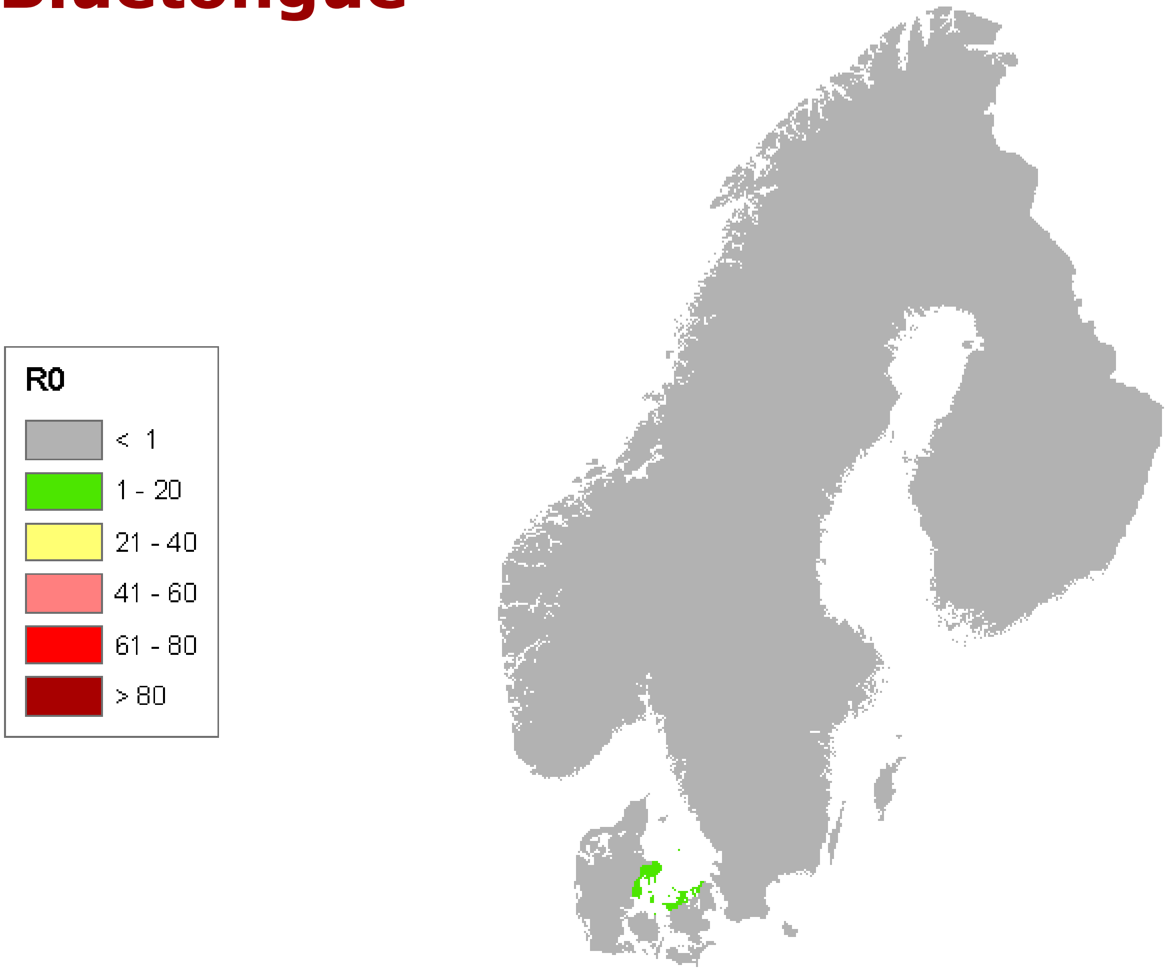
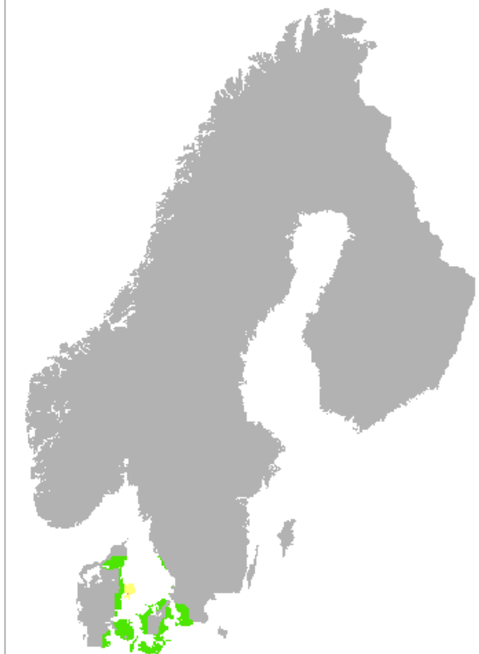


R_0 11 Aug 2008



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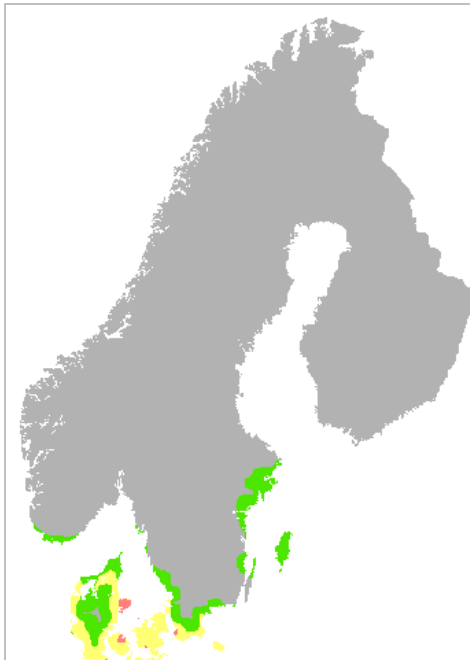

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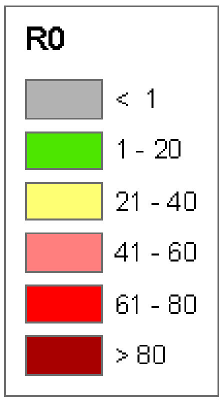
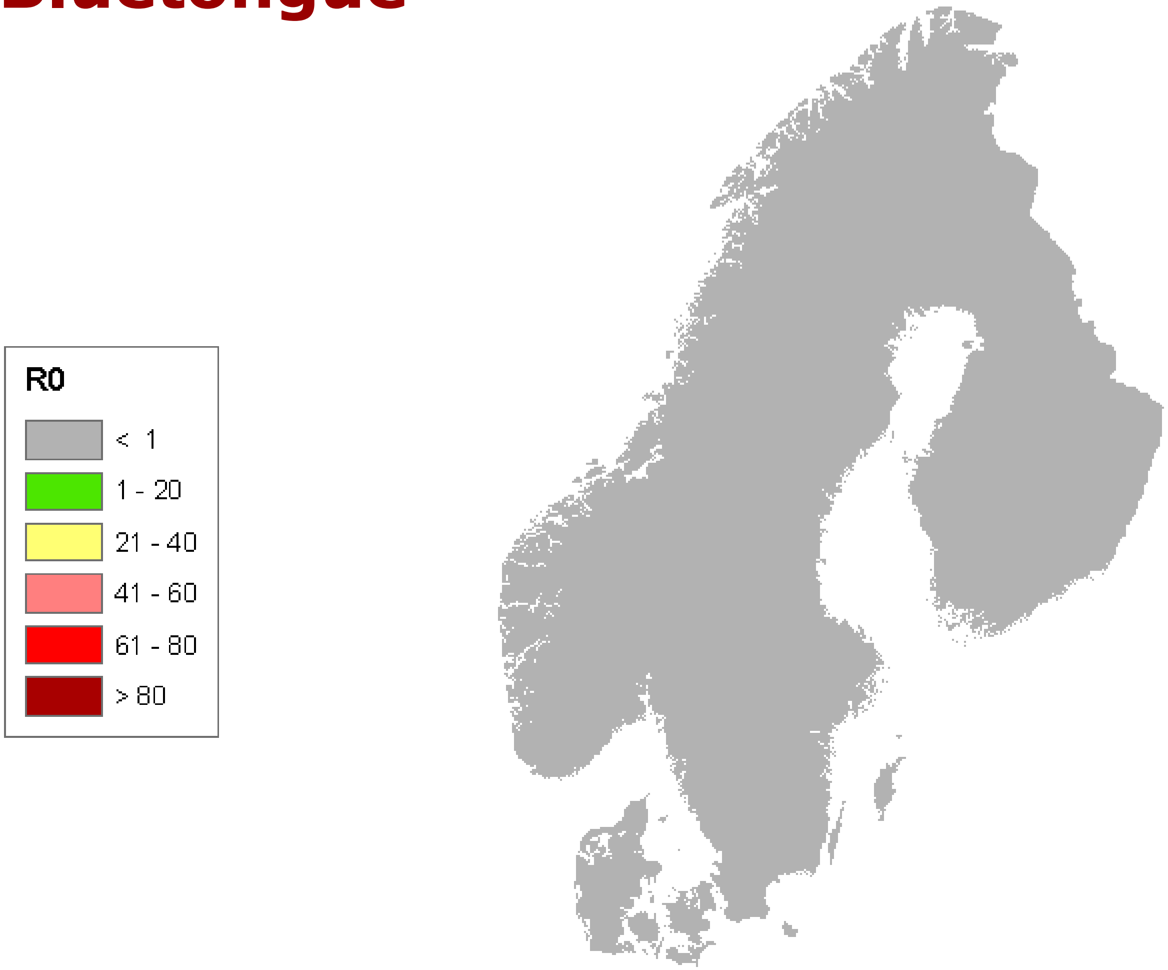


R_0 18 Aug 2008

40 years later

60 years later

Bluetongue



R_0 25 Aug 2008

40 years later

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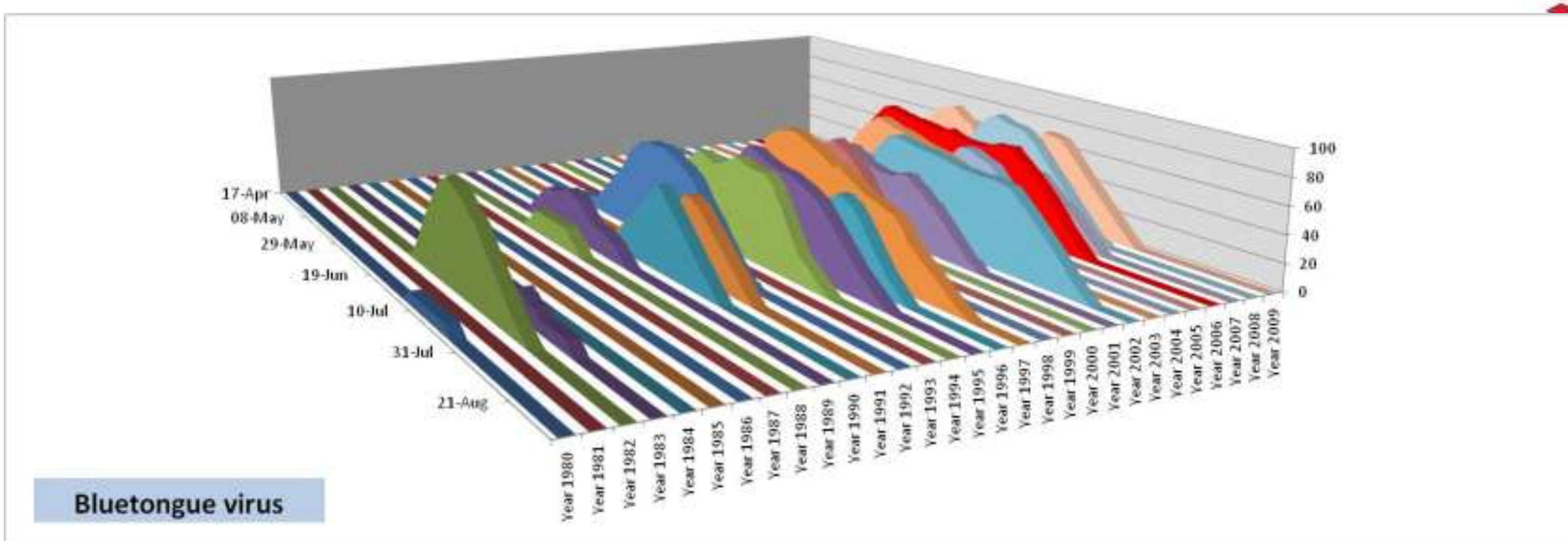
17-Apr
08-May
29-May
19-Jun
10-Jul
31-Jul
21-Aug
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80
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40
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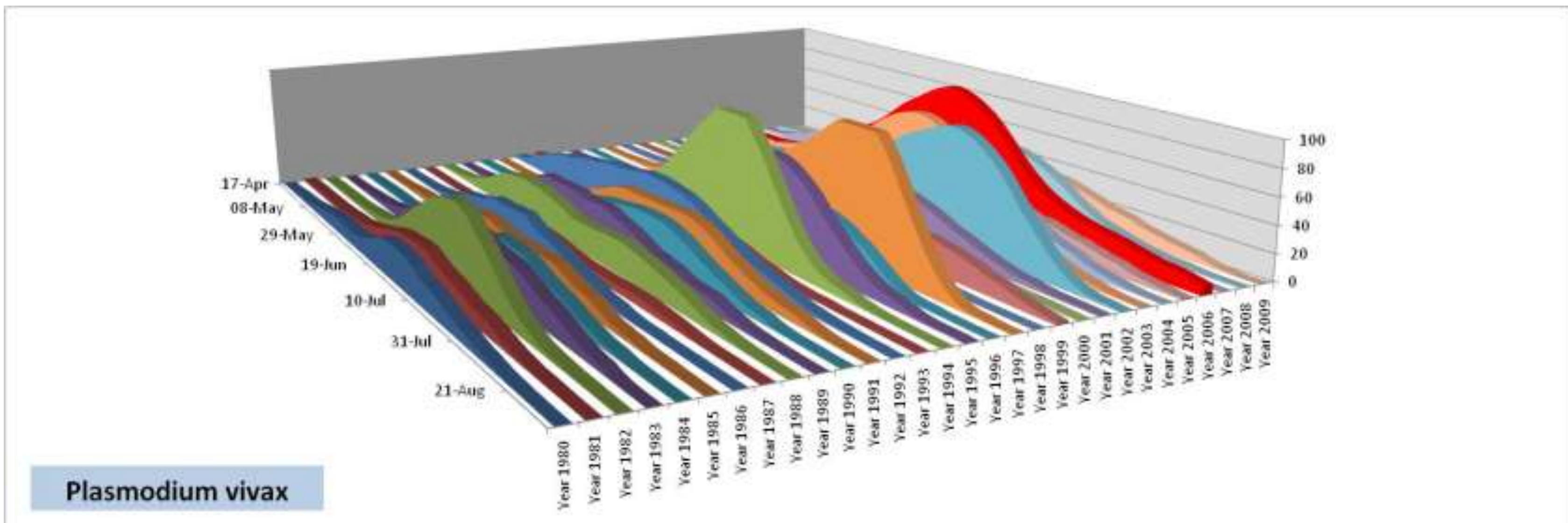
Year 2009
Bluetongue virus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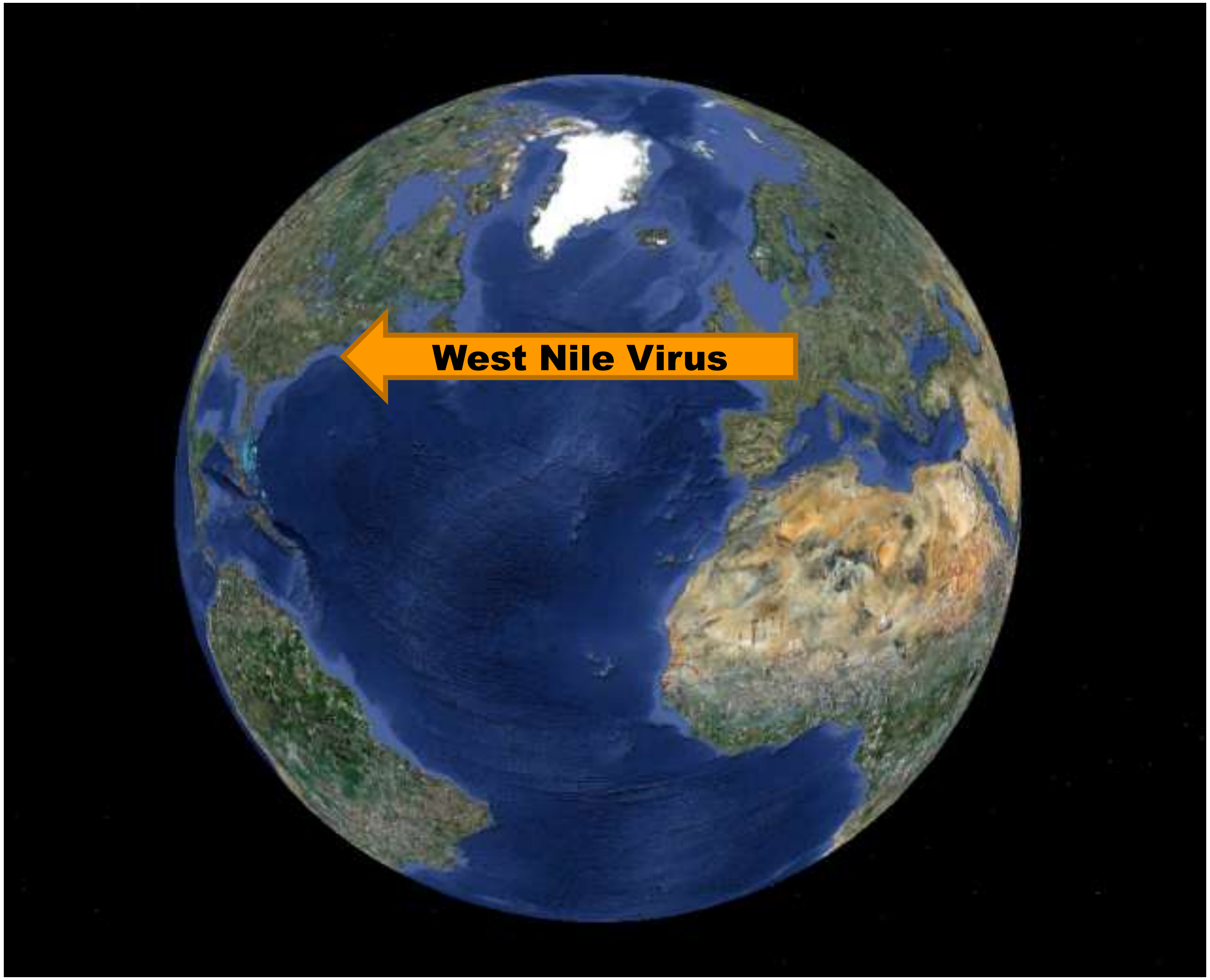
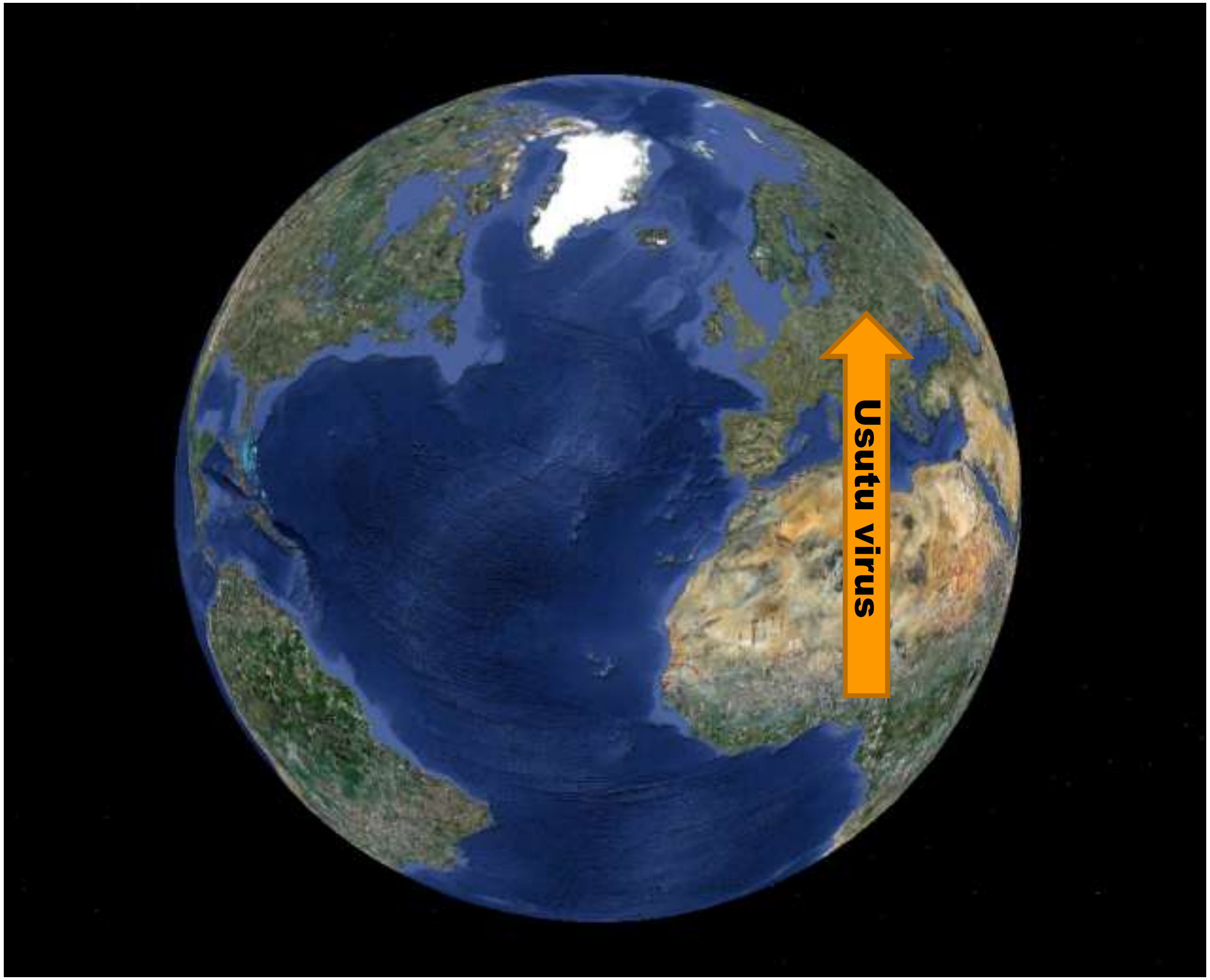
Plasmodium vivax

West Nile Virus & Usutu virus



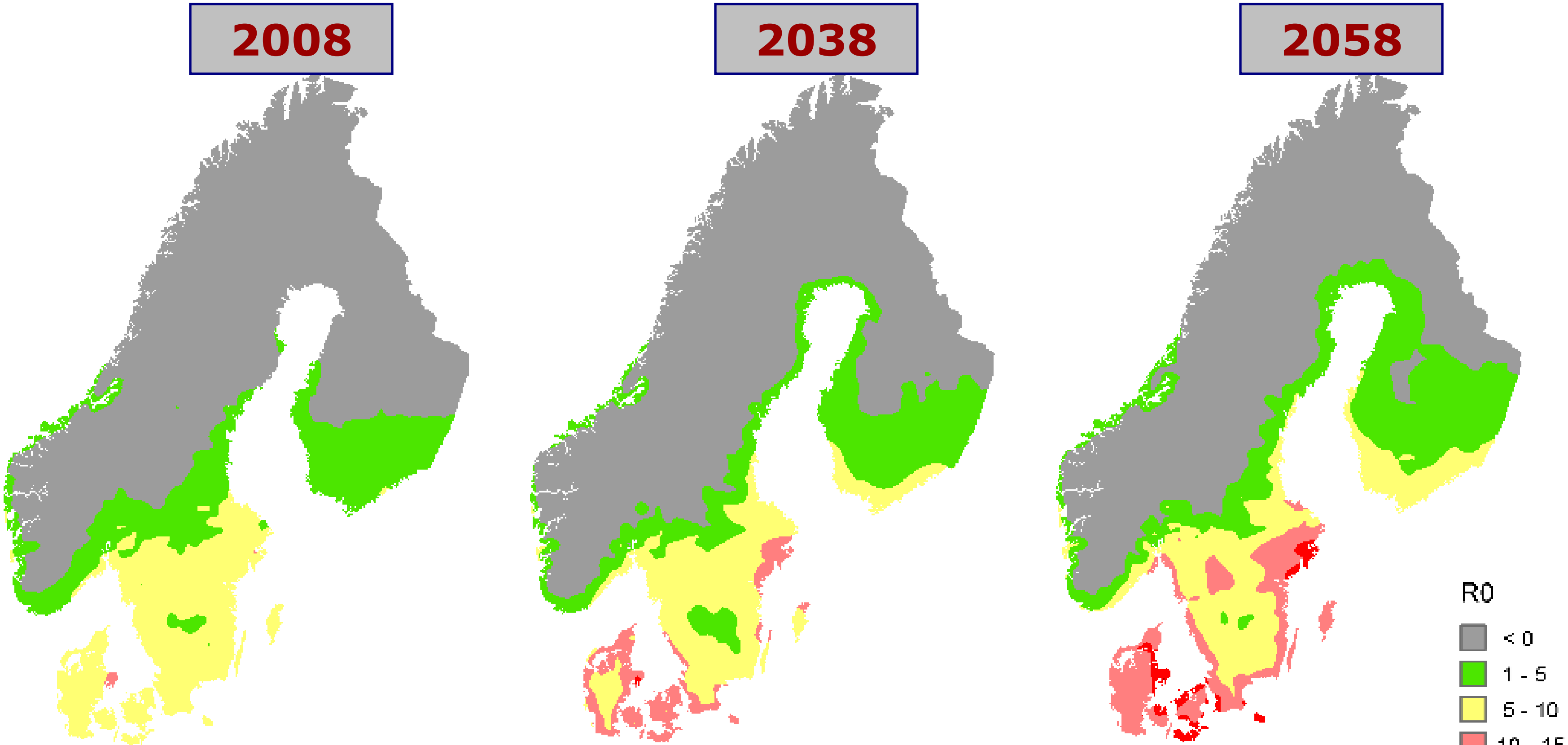
West Nile Virus & Usutu virus

West Nile Virus & Usutu virus



Human malaria

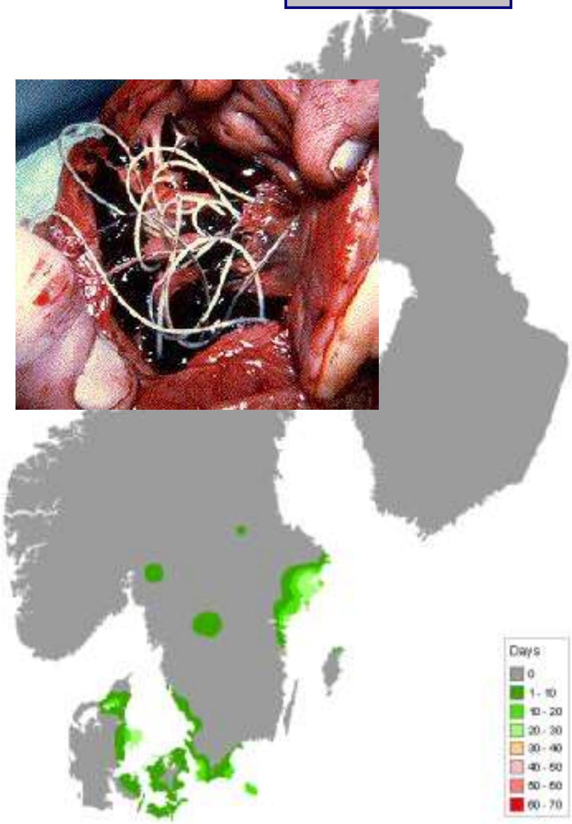
Malaria (P. vivax): Potential for spread given an introduction the 14th July



Avian malaria & climate change…
Global Change Biology 2011, **17**:1751

Dirofilaria in dogs (zoonoses): Annual number of days with infectious mosquitoes

2008

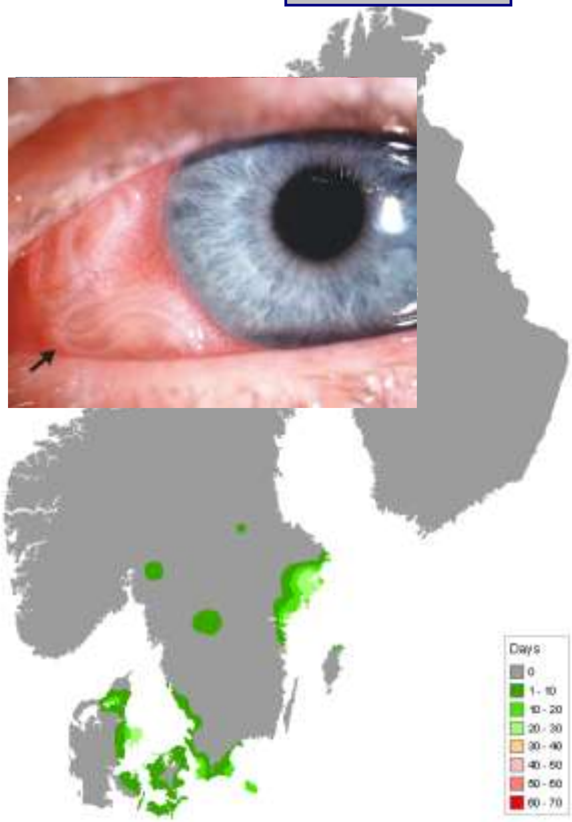


2038

2058

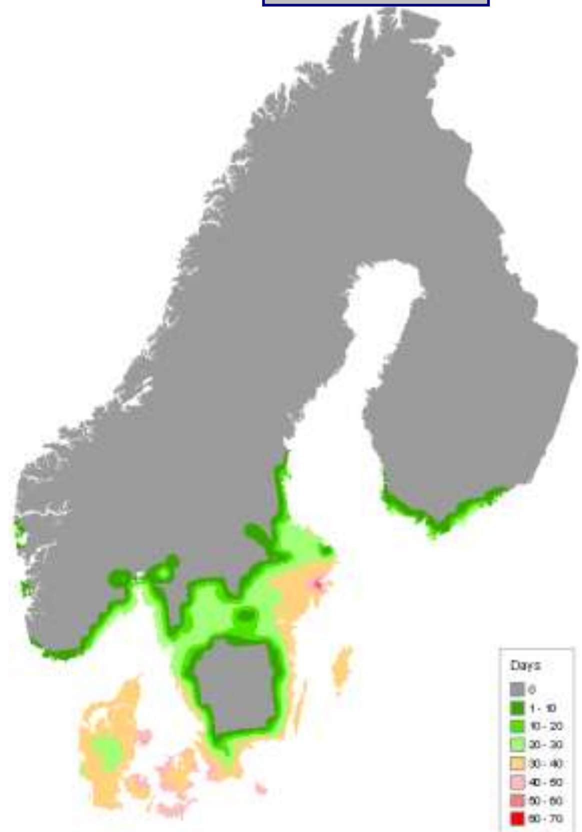
Dirofilaria in dogs (zoonoses): Annual number of days with infectious mosquitoes

2008



2038

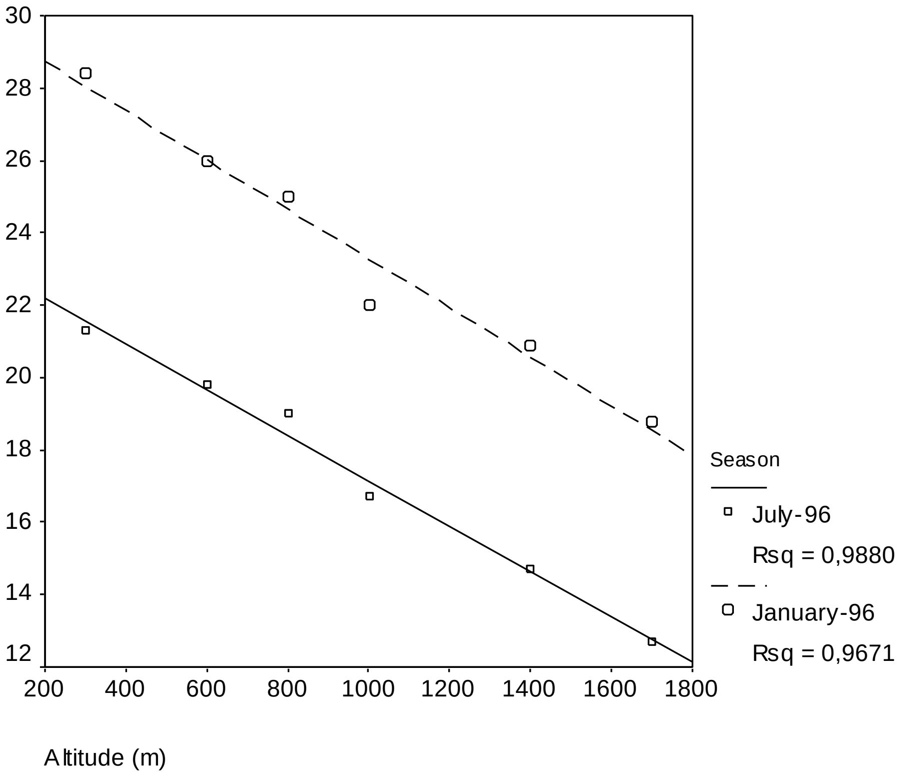
2058



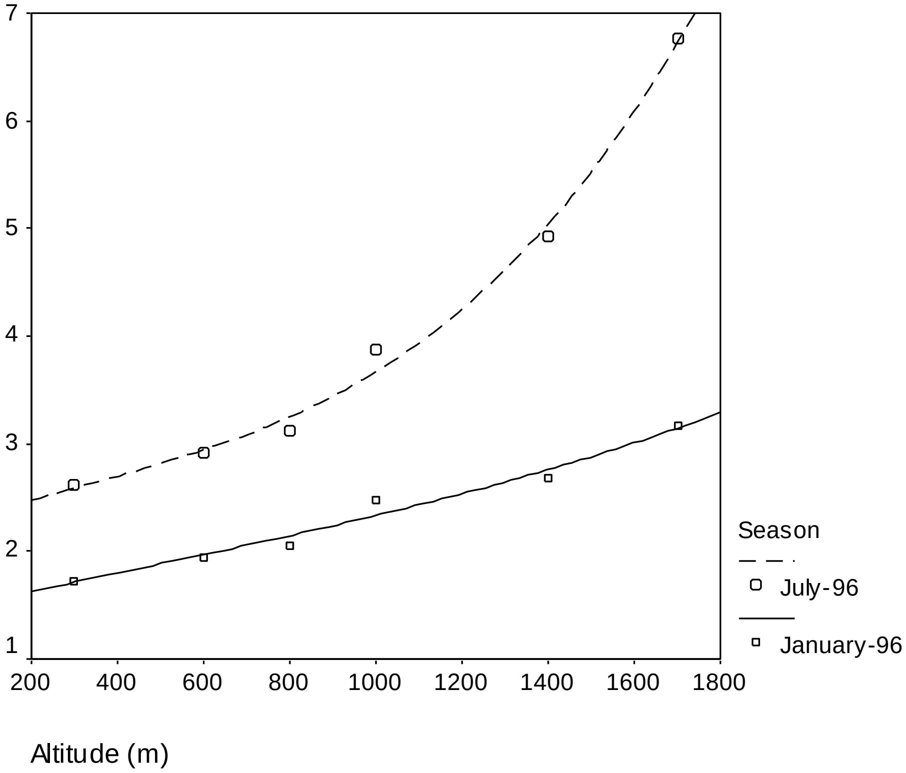
Dirofilaria in dogs (zoonoses): Annual number of days with infectious mosquitoes

2008

Lessons from the African highlands



Lessons from the African highlands



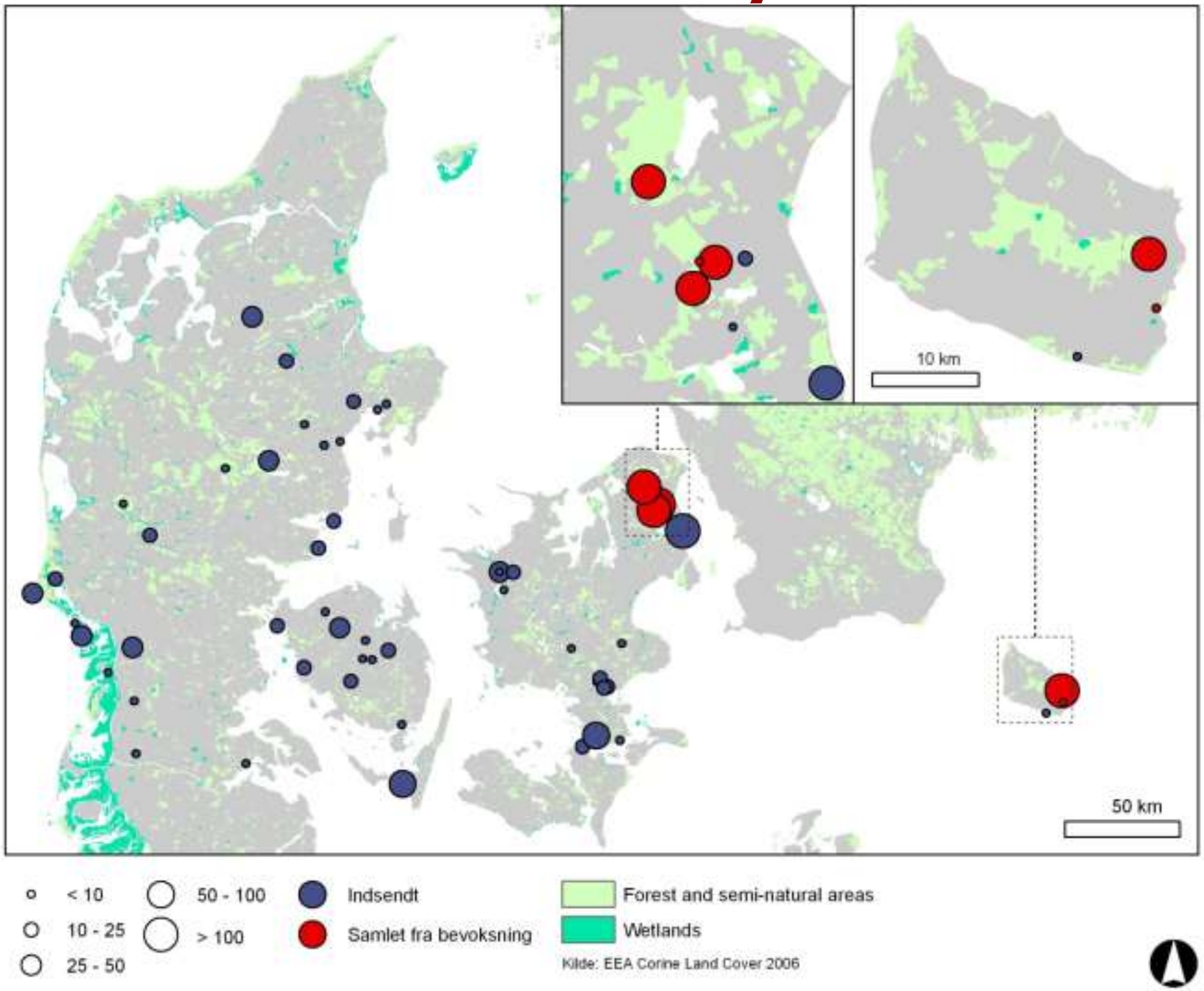
Lessons from the African highlands

Altitude	Vector density m	$a^2 * p^n / -\ln p$	C	R_0	C ($t = t_{300m}$)	C ($m = m_{300m}$)
300 m	21.1	0.84	11.5	4,206	**11.5**	**11.5**
600 m	3.9	0.55	1.1	417	**1.8**	**6.4**
800 m	1.7	0.45	0.3	120	**0.72**	**4.7**
1000 m	0.3	0.18	0.014	5.2	**0.09**	**1.3**
1400 m	0.06	0.09	0.008	3.0	**0.04**	**0.2**
1700 m	0.01	0.02	0.00002	0.007	**0.004**	**0.02**

Next step: Spatial vector models

CO_2 and octenol traps

Tick collected by CVS



Thank you
for your attention

René Bødker

rebo@vet.dtu.dk

R_0 maps environmental data and climate predictions for the Nordic countries are available at

www.NORDRISK.dk